PROJECT MANUAL
INCLUDING SPECIFICATIONS

FOR

REDONDO BEACH UNIFIED SCHOOL DISTRICT
REDONDO UNION HIGH SCHOOL
SEA HAWK BOWL
CONCOURSE IMPROVEMENTS

1 SEA HAWK WAY,
REDONDO BEACH, CA 90277

DSA A#03-126194

ARCHITECT

SVA ARCHITECTS
6 Hutton Centre Drive, Suite 1150
Santa Ana, CA 92707
Telephone: 949.809.3380

SVA Project Number:
2025-40137

06/22/2026



Robert Simons, AIA **C-18301**
Architect, SVA Architects Inc.



Young Nam **S4029**
Structural Engineer, VCA



Ahmed Zuwawa **C92059**
Civil Engineer, Kimley Horn



William Galarza, Jr. **M32627**
Mechanical Engineer, WSP



Raymond Swartz **E15610**
Electrical Engineer, WSP

SECTION 00 01 10

TABLE OF CONTENTS

PROJECT MANUAL
INTRODUCTORY INFORMATION

Document	00 00 05	Certifications Page
Document	00 01 10	Table of Contents

SPECIFICATIONS GROUP

DIVISION 01 – GENERAL REQUIREMENTS

Section	01 11 00	Summary of Work
	01 20 00	Payment Procedures
	01 23 00	Alternates
	01 25 00	Substitution Procedures
	02 26 00	Contract Modification Procedures
	01 30 00	Administrative Requirements
	01 31 00	Project Management and Coordination
	01 40 00	Quality Requirements
	01 50 00	Temporary Facilities and Controls
	01 60 00	Product Requirements
	01 70 00	Execution Requirements
	01 73 00	Cutting and Patching
	01 74 10	Waste Management
	01 77 00	Closeout Procedures
	01 78 00	Warranties
	01 79 00	Demonstration and Training
	01 81 15	*CAL*Green Environmental Requirements

DIVISION 02 – EXISTING CONDITIONS

Section	02 41 00	DEMOLITION
	02 41 10	Structure Demolition

DIVISION 03 – CONCRETE

Section	03 30 00	Cast-in-Place Concrete
	03 30 38	Integral Concrete Waterproofing
	03 35 15	Sealed Concrete Flooring

DIVISION 04 – MASONRY

Section	04 05 11	Masonry Mortaring and Grouting
	04 20 00	Unit Masonry

DIVISION 05 – METALS

Section	05 12 00	Structural Steel Framing
	05 31 00	Steel Decking
	05 40 00	Cold-Formed Metal Framing

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

NOT USED

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

Section	07 19 00	Water Repellent
	07 21 00	Thermal Insulation
	07 25 00	Weather-Resistive Barriers
	07 26 00	Below Grade Vapor Retarder
	07 41 15	Manufactured Standing Seam Roofing
	07 42 40	Metal Wall Panels
	07 51 00	Built-Up Bituminous Roofing
	07 55 00	Modified Bituminous Membrane Roofing
	07 60 00	Flashing and Sheet Metal
	07 90 00	Joint Sealants

DIVISION 08 – OPENINGS

Section	08 11 10	Hollow Metal Doors and Frames
	08 31 00	Access Doors and Panels
	08 71 00	Door Hardware
	08 91 00	Louvers

DIVISION 09 – FINISHES

Section	09 21 00	Gypsum Board Assemblies
	09 30 00	Tiling
	09 90 00	Painting and Coating
	09 96 20	Graffiti Resistant Coating

DIVISION 10 – SPECIALTIES

Section	10 14 00	Signage

10 28 00 Toilet Accessories
10 44 00 Fire Extinguisher Cabinets
10 44 10 Fire Extinguishers

DIVISION 11 – EQUIPMENT

Not used.

DIVISION 12 – FURNISHINGS

Not used.

DIVISION 13 – SPECIAL CONSTRUCTION

Not used.

DIVISION 14 – CONVEYING EQUIPMENT

Not used.

DIVISION 21 – FIRE SUPPRESSION

Not used

DIVISION 22 – PLUMBING

Section 22 05 00 Common Work Results For Plumbing
22 05 19 Meters and Gages For Plumbing Piping
22 05 23 General-Duty Valves For Plumbing Piping
22 05 29 Hangers and Supports For Plumbing Piping and Equipment
22 05 53 Identification For Plumbing Piping and Equipment
22 07 19 Plumbing Piping Insulation
22 11 16 Domestic Water Piping
22 11 19 Plumbing Specialties
22 13 16 Sanitary Waste and Vent Piping
22 14 13 Storm Drainage Piping
22 33 00 Electric Water Heaters
22 41 00 Plumbing Fixtures

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

Section 23 05 00 Common Work Results for HVAC
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 29 Hangers and Supports for HVAC Piping and Equipment

23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment
23 05 53 Identification for HVAC Piping and Equipment
23 05 93 Testing, Adjusting, and Balancing for HVAC
23 31 13 Metal Ducts
23 33 00 Air Duct Accessories
23 34 23 HVAC Power Ventilators
23 37 13 Diffusers, Registers, and Grilles

DIVISION 26 – ELECTRICAL

Section 26 00 00 General Electrical

DIVISION 27 – COMMUNICATIONS

Not used

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

Section 28 46 00 Fire Alarm System

DIVISION 31 – EARTHWORK

Section 31 00 00 EARTHWORK
31 10 00 SITE CLEARING
31 22 00 GRADING
31 23 00 EXCAVATION AND BACKFILL
31 23 33 TRENCHING AND BACKFILL

DIVISION 32 – EXTERIOR IMPROVEMENTS

Section 32 11 00 PAVEMENT BASE COURSES
32 12 16 ASPHALT PAVING
32 12 36 SEAL COAT
32 13 13 CONCRETE PAVING
32 17 23 PAVEMENT MARKINGS
32 17 26 DETECTABLE WARNING SURFACE
32 31 10 Chain Link Fences and Gates
32 31 20 Decorative Metal Fences and Gates

DIVISION 33 –UTILITIES

Section 33 10 00 WATER UTILITIES
33 30 00 SANITARY SEWER UTILITIES
33 40 00 STORM DRAIN UTILITIES

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Project consists of construction of *the demolition of 2 existing buildings and fencing. Construct 2 new cmu restroom buildings and an entrance canopy with gates and fences. Remove existing parking stripes and provide new striping. Paint existing building to match new buildings*

1. Items noted "NIC" (Not in Contract) will be furnished and installed by Owner or under separate contract.

a. Hazardous Materials Removal: Known hazardous materials will be removed under separate contract (NIC); inform Owner immediately where materials suspected of being hazardous are encountered.

b. Hazardous Materials Removal: Where materials suspected as being hazardous are encountered, inform Owner immediately. Work directly with Owner relating to hazardous materials.

1) Architect shall not be involved in determination, removal, or disposal of hazardous materials.

2. Owner reserves right to remove and retain possession of existing items prior to start of Contract.

B. Division 01: Where provisions of General Conditions relate to Project administration or work-related requirements of the Contract, those paragraphs are expanded in Division 01 - General Requirements.

1. General Conditions, Supplementary Conditions and Division 01 - General Requirements contain information necessary for completion of every part of Project.

2. Where items of Work are done under subcontracts, each item shall be subject to these conditions.

1.2 REQUIREMENTS INCLUDED

A. This section includes administrative provisions:

1. Work sequence.
2. Contractor use of premises.
3. Building occupancy.
4. Field engineering.

5. Lines and levels.
6. Regulatory requirements and reference standards.
7. Owner furnished Contractor installed (OFCI) products.
8. Owner pre-ordered products.

9. Special definitions.

1.3 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner and Architect.

1. Construct Work to accommodate Owner's occupancy requirements during construction period.

B. Perform construction in phases as indicated.

1.4 CONTRACTOR USE OF PREMISES

A. Limit use of premises for Work and construction operations and to allow for:

1. Building occupancy.
2. Work by other contractors.
3. Authorized access to restricted areas.
4. Public access to public areas.

B. Limit use of premises for Work and construction operations and to allow for work by other contractors.

C. Coordinate use of premises and access to site under direction of Owner or Architect.

1.1 BUILDING OCCUPANCY

A. Building will be occupied during construction for conduct of normal operations; cooperate with Owner to minimize conflict and to facilitate building operations.

1.2 FIELD ENGINEERING

A. Provide field engineering services; establish lines and levels by use of recognized engineering survey practices.

1. Surveyor: Engage California registered land surveyor to perform land surveying services required.

2. Engineer: Engage California registered professional engineer of discipline required to perform required engineering services.

B. Locate and protect control and reference points.

1. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Log to be available for reference.

a. Record deviations from required lines and levels.

b. Advise Architect when deviations that exceed indicated or recognized tolerances are detected.

c. Project Record Drawings: Record deviations that are accepted and not corrected.

d. Upon completion of foundation walls, major site improvements, and other work requiring field engineering services, prepare certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

1.3 LINES AND LEVELS

A. Establish lines and levels by use of recognized engineering practices.

B. Locate and protect control and reference points.

1.4 REGULATORY REQUIREMENTS AND REFERENCE STANDARDS

A. Regulatory Requirements:

1. Architect has contacted governing authorities and reviewed design requirements of local, state, and federal agencies for applicability to Project.

2. Contractor shall be responsible for contacting governing authorities directly for necessary information and decisions bearing upon performance of Work.

B. Reference Standards:

1. For Products specified by association or trade standards, comply with requirements of referenced standard, except when more rigid requirements are specified or are required by applicable codes.

2. Applicable date of each standard is that in effect as of date on proposal or date on Contract where no proposal is available, except when a specific date is specified.

1.5 OWNER FURNISHED CONTRACTOR INSTALLED (OFCI) PRODUCTS

A. Select products are to be furnished and paid for by Owner and installed by Contractor:

1. Refer to Drawings and Specifications.

B. Owner's Responsibilities:

1. Arrange for and deliver shop drawings, product data, and samples to Contractor.
2. Arrange and pay for product delivery to site.
3. Inspect products jointly with Contractor on delivery.
4. Submit claims for transportation damage.
5. Arrange for replacement of damaged, defective, or missing items.
6. Arrange for manufacturer's warranties, inspections, and service.

C. Contractor's Responsibilities:

1. Review shop drawings, product data, and samples.
2. Receive and unload products at site.
3. Inspect jointly with Owner for completeness and damage.
4. Handle, store, and install products.
5. Finish products as required after installation.
6. Repair or replace items damaged by Work of this Contract.

1.6 OWNER PRE-ORDERED PRODUCTS

A. Select products have been pre-ordered by Owner:

1. Refer to Drawings.

B. Owner has negotiated purchase orders for these products for incorporation into Project.

1. Purchase orders are assigned to Contractor; costs shall be included in the base bid.

2. Contractor's responsibilities are same as if Contractor negotiated purchase orders.

1.7 SPECIAL DEFINITIONS

A. Approved: Approved, directed, selected, required, ordered, designated, accepted, acceptable, and satisfactory shall require written action by Architect.

B. Equal, Approved Equal: Equal and approved equal shall require requests for substitutions for products or manufacturers not specified.

1. Requests for substitutions shall be in accordance with requirements of Section 01 25 00 - Substitution Procedures.

C. Furnish: Furnish means supply and deliver to Project, unless otherwise defined in greater detail.

D. Install: Install is used to describe operations at Project, from inspecting and unloading, to completion in place, ready for intended use.

E. Provide: Provide means furnish and install, complete and ready for intended use, unless otherwise defined in greater detail.

END OF SECTION

SECTION 01 20 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Special administrative and procedural requirements necessary to prepare and process Application for Payment.

1.2 SCHEDULE OF VALUE

A. Coordination: Coordinate preparation of Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in Schedule of Values with other required administrative forms and schedules, including application for Payment forms with Continuation Sheets, Submittals Schedule, and Contractor's Construction Schedule.

2. Submit Schedule of Values to Architect at earliest possible date but no later than seven days before date scheduled for submittal of initial Application for Payment.

B. Format and Content: Use Project Manual table of contents as guide to establish line items for Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include following Project identification on Schedule of Values.

a. Project name and location.
b. Name of Architect.
c. Architect's Project number.
d. Contractor's name and address.
e. Date of submittal.

2. Submit draft of AIA Document G703 Continuation Sheets or comparable format approved in advance by Architect.

3. Provide breakdown of Contract Sum in enough detail to facilitate continued evaluation of Application for Payment and progress reports. Coordinate with Project Manual table of contents.

a. Provide several line items for principal subcontract amounts where appropriate.

4. Round amounts to nearest whole dollar; total shall equal Contract Sum.

5. Provide separate line item in Schedule of Values for each part of Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

6. Provide separate line items in Schedule of Value for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of Work.

7. Each item in Schedule of Values and Application for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in Schedule of Values or distributed as general overhead expense at Contractor's option.

8. Schedule Updating: Update and resubmit Schedule of Values before next application for Payment when Change Orders or Construction Change Directives result in a change in Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

    1. Initial Application for Payment: Application for Payment at time of Completion, and final Application for Payment involves additional requirements.

B. Payment Application Times: Date for each progress payment is indicated in Agreement between Owner and Contractor. Period of construction Work covered by each Application for Payment is period indicated in Agreement.

C. Payment Application Forms: AIA Document G702 and AIA Document G703 Continuation Sheets as form for Application for Payment unless comparable forms have been approved in advance by Architect.

D. Application Preparation: Complete every entry on form. Execute by person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

    1. Entries shall match data on Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.

    2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal:

    1. Contractor shall provide copy of Application for Payment one week prior to Payment Request ("Draw") Meeting, for review of team members.

    2. Contractor shall provide ten wet signed copies of Application for Payment at Payment Request ("Draw") Meeting, alternate methods subject to prior Architect review and approval.

        a. Provide each copy with transmittal form listing attachments and recording appropriate information about application.

b. Copies shall include waivers of lien and similar attachments if required.

F. Waivers of Mechanic's Lien: With each Application for Payment submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of Contract and related to Work covered by payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.

2. When an application shows completion of an item, submit final or full waivers.

3. Owner reserves right to designate which entities involved in Work submit waivers.

4. Waiver Forms: Submit waivers of lien on executed forms acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following.

1. List of subcontractors.

2. Schedule of Values.

3. Contractor's Construction Schedule (preliminary if not final).

4. Schedule of unit prices.

5. Submittals Schedule (preliminary if not final).

6. List of Contractor's staff assignments.

7. List of Contractor's principal consultants.

8. Copies of building permits.

9. Copies of authorizations and licenses from authorities having jurisdiction for performance of Work.

10. Initial progress report.

11. Report of preconstruction conference.

12. Certificates of insurance and insurance policies.

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted including but not necessarily limited to following.

1. Evidence of completion of Project closeout requirements.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.

3. Updated final statement accounting for final changes to Contract Sum.

4. Provide following documents or comparable documents approved in advance by Architect.

    a. AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims.
    b. AIA Document G706A, Contractor's Affidavit of Release of Liens.
    c. AIA Document G707, Consent of Surety to Final Payment.

5. Evidence that claims have been settled.

6. Final meter readings for utilities, a measured record of stored fuel, and simliar data as of date of Completion.

7. Final liquidated damages settlement statement.

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes a description of alternate work.

B. Related Requirements:

1. Pricing Documents: Quotation of each alternate’s cost.

2. Owner-Contractor Agreement: Alternates accepted by Owner for incorporation into Work.

3. Sections of Specifications identified in each Alternate.

1.2 PROCEDURES

A. Alternates will be exercised at Owner's option.

B. Coordinate related work and modify surrounding work as required to complete Work, including changes under each alternate, when acceptance is designated in Owner-Contractor Agreement.

1.3 ALTERNATES

A. Alternates: To be determined.

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. General: Procedures are described for requesting substitution of unlisted materials in lieu of materials named in Specifications or approved for use in addenda.

1. Provide products listed in Contract Documents, products by manufacturers listed in Contract Documents, and products meeting specified requirements.

a. Contract Amount: Base on materials and products included in Contract Documents.

b. Where materials and products are listed in Contract Documents, materials and products by manufacturers not listed shall not be used without Owner’s and Architect’s approval of Contractor's written request for substitution.

2. Purpose: After bidding, substitutions will only be considered where Owner will receive benefit or because specified materials are no longer available due to no fault of Contractor.

3. Purpose: Substitutions will only be considered where Owner will receive benefit or because specified materials are no longer available due to conditions beyond Contractor control.

a. Owner benefits either from a Contractor proposed reduction of the Contract amount or from a reduction in Contract time based on acceptance of proposed substitution.

b. List proposed cost or time reductions on request for substitution.

c. Requests not including a proposed cost or time reduction will not be considered unless Contractor submits supporting information indicating specified materials are not available.

B. Related Sections:

1. Section 01 60 00: Product requirements.

1.2 SUBSTITUTIONS

A. Within a period of 35-days after award of Contract, Owner and Architect will consider formal requests for substitutions only from Contractor as specified in 1.1 Summary.

1. Owner and Architect will consider only one request for substitution for each material; where requests are denied Contractor shall be required to provide specified materials.

2. After initial 35-day period, requests will be considered only when a product becomes unavailable through no fault of Contractor; more than one request for substitution will be considered if necessary.

B. Prior to submittal of second Request for Payment Owner and Architect will consider formal requests for substitutions from Contractor as specified in 1.1 Summary.

1. Owner and Architect will consider only one request for substitution for each material; where requests are denied Contractor shall be required to provide specified materials.

2. After payments begin, requests will be considered only when a product becomes unavailable through no fault of Contractor; more than one request for substitution will be considered if necessary.

C. Submit each request with sequentially numbered “Substitution Request Transmittal” acceptable to Owner and Architect; submit separate request for each product and support each request with:

1. Product identification with manufacturer's literature and samples where applicable.

2. Name and address of similar projects on which product has been used, and date of installation.

D. Submit itemized comparison of proposed substitution with specified products and list significant variations.

E. Submit data relating to changes in construction schedule.

F. Note effect of substitution on other work, products, or separate contracts.

1. Note if acceptance of substitution could require revision of Contract Documents, Drawings, details, or Specifications.

G. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract price.

1. Include costs to other contractors and costs for revisions to Drawings, details or Specifications.

H. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on submittals without a formal request from Contractor.

2. They are requested directly by a subcontractor or supplier.

3. Acceptance will require substantial revision of Contract Documents.

I. Substitute products shall not be ordered without written acceptance of Owner and Architect.

J. Owner and Architect will determine acceptability of proposed substitutions and reserves right to reject proposals due to insufficient information.

1.3 CONTRACTOR'S REPRESENTATION

A. Requests constitute a representation that Contractor:

1. Has investigated proposed product and determined whether it meets or exceeds, in all respects, specified product.

2. Will provide same warranty or longer warranty for substitution as for specified product.

3. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.

4. Waives claims for additional costs that subsequently become apparent.

5. Will pay costs of changes to Contract Documents, Drawings, details, and Specifications required by accepted substitutions.

1.4 ARCHITECT DUTIES

A. Review Contractor's requests for substitutions with reasonable promptness.

1. Architect will recommend that Owner accept or reject substitution request.

2. Upon request, Architect will provide cost for changes to Contract Documents, Drawings, details, and Specifications required for substitutions.

B. Notify Contractor in writing of decision to accept or reject requested substitution.

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: This section specifies administrative and procedural requirements governing Contract modification procedures.

1. Requests for Information (RFI).
2. Change Order.
3. Allowances.
4. Construction Change Directive.

B. Related Requirements:

1. Section 01 25 00: Substitution procedures.
2. Section 01 30 00: Administrative requirements.

1.2 MINOR CHANGES IN WORK

A. Architect will issue supplemental instructions authorizing minor changes in Work, not involving adjustment to Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions or similar form approved in advance by Architect.

1.3 REQUESTS FOR INFORMATION

A. Contractor may submit a written Request for Information (RFI) in format approved by Architect relating to perceived inconsistencies and omissions in Contract Documents.

1. A record of RFI's is to be maintained by Contractor along with information regarding origin of request, date of request, and date request was received from Architect. Number RFI's sequentially based on date of request.

B. Requests for Information shall be used only as a means of obtaining clarification of information not included in Contract Documents and shall not be used to assist Contractor in preparation of shop drawings or other information required by Contract.

1. Contract Documents are intended to contain enough information to show aesthetic and design intent and to provide information such that construction procedures (means and methods) may be reasonably inferred.

2. Contract Documents are not intended to provide specific information related to means and methods of construction nor are they intended to be exhaustive in content.

C. Contractor shall carefully review requests for information by subcontractors and suppliers to ascertain if information is in Contract Documents prior to submitting a Request for Information to Architect based on requests by others.

1. Contractor may suggest possible solutions to fit Project conditions where appropriate.

D. Architect reserves right to return RFI's that do not reasonably relate to necessary clarification of intent of Contract Documents and to charge Contractor for time and materials involved in answering RFI's where information is in Contract Documents.

1. RFI's shall not be used as a request for substitutions; refer to Section 01 25 00 – Substitution Procedures.

1.4 CHANGE ORDERS

A. Owner-Initiated Proposal Requests: Architect will issue detailed description of proposed changes in Work that require adjustment to Contract Sum or Contract Time. If necessary, description will include supplemental or revised Drawings and Specifications.

1. Proposal requests issued by Architect are for information only. Do not consider changer order proposal requests as instruction either to stop work in progress or to execute proposed change.

2. Within 10 days of receipt of a proposal request, submit estimate of cost necessary to execute change to Architect for Owner's review.

a. Include list of quantities of products required and unit costs, with total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

b. Indicate applicable taxes, delivery charges, equipment rental and amounts of trade discounts.

c. Include a statement indicating effect of proposed change in Work will have on Contract Time.

B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to Contract, Contractor may propose changes by submitting a request for a change to Architect and Owner.

1. Include statement of reasons for change and effect of change on Work. Provide a complete description of proposed change. Indicate effect of proposed change on Contract Sum and Contract Time.

2. Include a list of quantities of products required and unit costs with total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental and amounts of trade discounts.

4. Comply with requirements in Section 01 25 00 - Substitution Procedures if proposed change requires substitution of unspecified product or system for specified product or system.

C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests; other formats to be submitted to Owner and Architect for prior approval.

D. Change Order Procedures: Contractor shall be directed to proceed with Work upon Owner's approval of Proposal.

1. Architect will issue Change Order for signatures of Owner and Contractor on AIA Form G701 or similar form approved in advance by Owner and Architect, including approved Change Order proposals for that period.

2. Amounts for each Change Order shall be indicated in each Request for Payment including payment status for each individual Change Order.

1.5 ALLOWANCES

A. Allowance Adjustment: For Contract items bid based on allowance, submit Change Order Proposal on difference between actual purchase amount and allowance, based on work-in-place.

1. Include installation cost in purchase amount only where indicated as part of allowance.

2. When requested, prepare explanations and documentation to substantiate amounts claimed for work done based on allowances.

3. Submit substantiation of a change in Scope of work claimed in Change Orders related to allowances.

4. Owner reserves right to establish actual quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increasing costs because of a change in scope or nature of allowance described in Contract Documents, whether for purchase order amount or Contractor's handling, labor, installation, overhead and profit.

1. Submit claims within 21-days of receipt of Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21-days.

2. Do not include Contractor's or subcontractor's indirect expense in Change Order cost amount unless it is clearly shown that nature or extent of work has changed from what could have been foreseen from information in Contract Documents.

3. No change to Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of same scope and nature as originally indicated.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When Owner and Contractor disagree on terms of Proposal Request, Architect may issue a Construction Change Directive per AIA Form G714 or similar form approved in advance by Owner and Architect.

1. Construction Change Directive instructs Contractor to proceed with change in Work, for subsequent inclusion in Change Order.

2. Construction Change Directive contains a complete description of change in Work. It also designates method to be followed to determine change in Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of Work required by Construction Change Directive. Coordinate scheduling with Construction Manager to allow monitoring by Owner if desired.

1. After completion of change, submit itemized account and supporting data necessary to substantiate cost and time adjustments to Contract.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes general procedural requirements for ongoing submittals.

1. Construction progress schedules.
2. Schedule of values.
3. Product data and manufacturer’s literature.
4. Shop drawings.
5. Samples.
6. Manufacturers' certificates.
7. Excess materials and attic stock.
8. Design build (delegated design) procedures.

B. Related Requirements:

1. Section 01 40 00: Test reports, manufacturer's field reports, and mock-ups.
2. Section 01 70 00: Manufacturers’ instructions.
3. Section 01 77 00: Closeout requirements including Project Record Documents.
4. Section 01 78 00: Warranties.

1.2 GENERAL SUBMITTAL PROCEDURES

A. Submittals: Transmit each item using form approved by Architect; submit sample to Architect for approval prior to use.

1. Identify Project, Contractor, subcontractor, major supplier.

a. Attach sequential identification number for each new submittal.

b. Identify each resubmittal using original submittal number and sequential identification clearly indicating item is resubmitted.

2. Identify pertinent Drawing sheet and detail number, and Specification section number as appropriate.

3. Identify deviations from Contract Documents.

4. Provide space for Contractor and Architect review stamps.

5. Contractor: Review and stamp submittals from subcontractors prior to submitting to Architect.

a. Review submittals and indicate where conflicts occur with Contract Documents and with work of other subcontractors.

b. Return submittals that vary significantly from Contract Documents for correction and resubmittal prior to submitting to Architect.

c. Submittals that vary significantly from Contract Documents and that fail to indicate thorough Contractor review prior to submission to Architect will be returned without review.

d. Cursory review and stamping of subcontractor submittal by Contractor shall not be acceptable.

B. Initial Schedules: Submit initial progress schedule and schedule of value within 15 working days after award of Contract in format acceptable to Owner and Architect.

1. After review by Owner and Architect revise and resubmit where required.

C. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.

D. After Architect review of submittal, revise and resubmit as required, identify changes made since previous submittal.

1. Submittals Requiring Architect Response: Allow reasonable time for Architect review as well as time for preparation of resubmittals where required by Architect.

a. Architect will attempt to respond within 10 working days, however, extent (multiple submittals received at same time) and difficulty of some submittals may require longer review period.

b. Do not delay submittals and do not consider Architect review time as part of Project Schedule as multiple submittals and reviews may be required.

E. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply.

1.3 TYPES OF SUBMITTALS

A. General: Project requires various types of submittals to maintain communications, minimize misunderstandings, avoid unnecessary conflicts, and to ensure complete documentation for Project Record Documents.

1. Maintain complete set of submittals including required revisions.

B. Construction Schedules: Submit construction progress schedules for Design Team and Owner review and maintain entire team up to date on construction activities.

C. Schedule of Values: Submit Schedule of Values indicating division of Work, subcontractors to perform work, products being used, and values attributed to each to inform Design Team and Owner.

D. Action Submittals: Submittals relating to product data and manufacturer’s literature, shop drawings, and samples for Design Team review and comment; do not begin fabrication, delivery, or installation until Design Team review is complete.

E. Information Submittals: Submittals relating to certifications, qualifications, reports, including test reports, and instructions are for information; Design Team may choose to comment but action is not generally anticipated.

1. Manufacturer installation instructions and recommendations shall be considered information submittals.

F. Design/Build Submittals: Where portion of Work requires design by specialized professionals submit information necessary to ensure work complies with Contract Documents along with certifications signed by qualified professional.

1. Calculations: Do not submit calculations unless specifically required by Contract Documents; submit calculations required by code directly to authorities having jurisdiction.

a. Submit certification by qualified professional indicating required calculations have been prepared and work conforms to Contract Documents and applicable codes and regulations.

G. Maintenance Materials Submittals: Compile maintenance information and materials during Work to ensure complete set of documents, maintenance manuals, and operation instructions.

H. Closeout Submittals: Compile closeout submittals, organize, and submit to Owner prior to or at time of Substantial Completion. Project will not be considered Substantially Complete until closeout submittals have been received by Owner.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. Submit construction progress schedule with separate item for each major trade and operation, identifying first day of each week.

1. Show complete sequence of construction by activity, identifying work of separate stages and logically grouped activities.

2. Show projected percentage of completion for each item of Work as of time of each progress Application for Payment.

3. “Submittal Schedule”: Show Contractor submittal dates required for shop drawings, product data, and samples, and product delivery dates; deliver to Architect per approved “Submittal Schedule.”

a. “Submittal Schedule” may be incorporated into construction progress schedule or may be separate, Contractor option.

b. Architect’s Review Period: Architect will be expedient in review however Contractor shall schedule submittals recognizing possibility Architect may reject and may require resubmittal.

c. Contract extension shall not be allowed for Contractor’s failure to properly schedule submittals to allow for Architect requiring resubmittal.

B. Progress Schedule Format: Submit both horizontal bar chart and network analysis system using critical path method as approved by Owner.

1. Submit revised progress schedules with each Application for Payment reflecting changes since previous submittal, not less than monthly.

C. Progress Schedule Format: Horizontal bar chart as approved.

1. Contractor Option: Submit network analysis system using critical path method as approved by Owner and Architect.

2. Submit revised progress schedules with each Application for Payment reflecting changes since previous submittal, not less than monthly.

1.5 SCHEDULE OF VALUES

A. Submit typed schedule on AIA Form G703 or another Owner and Architect pre-approved format; Contractor's standard media-driven printout will be considered on request. Submit within 15-days after award of Contract.

B. Format: Table of Contents of this Project Manual, with modifications as pre-approved by Owner and Architect; identify each line item with number and title of major Specification sections.

C. Owner reserves right to assume each line item relates to a directly proportional amount of Contractor overhead and profit where listed as a single amount, unless otherwise indicated in Schedule of Value.

D. Revise schedule to list change orders for each Application for Payment.

1. Submit subschedule for each phase of Work.

1.6 PRODUCT DATA/MANUFACTURERS' LITERATURE

A. Action Submittals: Mark each copy to identify applicable Products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work.

B. Information Submittals: Include manufacturers' installation instructions only when required by Specifications or specifically requested by Architect.

1. Maintain copy of manufacturer installation instructions and recommendations in Contractor's field office for review.

C. Product data shall be submitted as electronic PDF files unless otherwise noted or approved by Architect in advance.

1. Where paper copies are permitted, submit number of copies Contractor requires, plus one copy to be retained by Architect.

D. Submit number of copies Contractor requires, plus one copy to be retained by Architect.

1.7 SHOP DRAWINGS

A. Shop drawings to illustrate requirements of Contract Documents, accurately show relevant field conditions, dimensions, quantities, kinds of materials, methods of assembly, and data required for fabrication, erection, and installation.

B. Shop drawings shall be submitted as electronic PDF files unless otherwise noted or approved by Architect in advance.

1. Where prints are permitted submit one reproducible print, minimum sheet size 8-1/2” by 11”.

C. Shop drawings shall be submitted in reproducible format acceptable to Architect and Owner; computerized PDF files will be acceptable unless otherwise directed.

1. Prints: Submit one reproducible print; minimum sheet size 8-1/2” by 11”.

2. Prints: Submit three reproducible prints; minimum sheet size 8-1/2" by 11".

D. Distribution: After review, reproduce and distribute.

1.8 SAMPLES

A. Submit full range of manufacturers' standard colors, textures, and patterns for Architect's selection.

B. Submit samples to illustrate functional characteristics of Product, with integral parts and attachment devices.

C. Coordinate submittal of different categories for interfacing work.

D. Include identification on each sample, giving full information.

E. Submit number of samples required by Contractor plus one to be retained by Architect.

1. Maintain one set of approved samples at Project Field Office.

F. Sizes: Provide following sizes unless otherwise specified.

2. Flat or Sheet Products: Minimum 6" square, maximum 12" by 12".
3. Linear Products: Minimum 6", maximum 12" long.
4. Bulk Products: Minimum one pint, maximum one gallon.

G. Full size samples may be used in the Work upon approval.

1.9 MANUFACTURERS' CERTIFICATES

A. Submit certificates as electronic PDF files unless otherwise noted or approved by Architect in advance, and in accordance with requirements of each Specification section.

1.10 EXCESS MATERIALS AND ATTIC STOCK

A. Excess Materials: Excess materials shall be considered property of Owner; inform Owner of extent of excess materials and methods required for handling and storage; remove from site excess materials not required by Owner for maintenance stock.

B. Attic Stock: Owner may choose to obtain additional attic stock for maintenance purposes where excess materials are not considered adequate.

1. Owner may require as much as 5% extra materials for maintenance purposes. Exact amount of each material shall be determined by Owner based on following meeting and additional costs determined by Contractor.

a. Contractor shall be prepared to order up to 5% extra materials on items that may not be readily available in future such as custom colors, offshore manufacture, anticipated life span under 5 years, and potential for damage.

1) Do not order extra attic stock until extent is determined and agreed to by Owner including which materials require extra stock and exactly how much those materials will cost including shipping and handling.

b. Excess Materials: Furnish excess materials only for materials that have a shelf-life of more than two years.

2. Meeting: Conduct meeting prior to beginning Work to discuss extent of materials Owner would like to receive at Project Closeout for attic stock for maintenance materials. Where available include personnel from Owner’s maintenance crew.

a. Estimate excess materials to be anticipated to be ordered in addition to materials for handling and storage and how those materials will be invoiced and identified regarding material and location in Project.

b. Determine area necessary for adequate storage, handling, and identifying excess materials and attic stock and discuss with Owner.

c. Submit information regarding equipment necessary for handling of excess materials and attic stock due to weight, size, and storage requirements.

d. Assist Owner in determining where on-site or off-site additional attic stock for maintenance purposes will be delivered and stored.

3. Additional Costs: After meeting submit to Owner detailed listing of additional costs for each material Owner may like to receive for attic stock and assist Owner in modifying listing to determine acceptable final costs.

a. Include unit prices for desired attic stock where excess materials are not adequate for Owner maintenance stock.

4. Substantial Completion: Submit Construction Bulletin at Substantial Completion indicating changes to Contract Amount for attic stock including unit price totals for materials where excess materials are not adequate.

5. Final Completion: Ensure attic stock has been received, identified, cataloged, and stored at locations agreed upon with Owner based on Change Order indicating amounts finally agreed to by Owner.

1.11 DELEGATED DESIGN PROCEDURES

A. Design as Part of Means and Methods of Construction: Select Project components require construction team design as part of means and methods of construction as described in various sections.

1. Terms commonly used such as Delegated Design and Design-Build are applicable to these procedures as determined by law but shall be generally referred to in these documents as Delegated Design.

a. In general Design/Build includes design by licensed professionals with expertise beyond that allowed under standard architectural licensure, and outside of scope of work of other design professionals on the design team.

b. In general Design Assist relates to design processes by a contractor, subcontractor, fabricator, or others to assist in determining constructability of Project prior to bidding.

2. Contractor may be required to provide design services as part of construction for specific work defined as delegated design where special expertise is required that is not available in the Project design team.

3. Subcontractors, fabricators, and manufacturers may be required to provide delegated design services as part of their work due to special expertise in design services for their specific components.

a. Refer to technical sections for Delegated Design.

4. Contractor, subcontractors, fabricators, manufacturers, and suppliers shall be responsible for attachments, anchors, fasteners, adhesives, and connectors suitable to applications unless specific items are listed in Contract Documents.

a. Where specific items are listed in Contract Documents Contractor, subcontractors, fabricators, manufacturers, and suppliers shall review and submit comments where items listed are not acceptable.

b. Where no comments are received, listed items shall be considered acceptable.

B. Contractor acknowledges and accepts responsibility for specialty design as part of means and methods of construction, as well as coordination of parties involved to achieve architectural design intent indicated in Contract Documents.

3. Delegated design work includes sizing, sequencing, and detailing for construction by professional licensed or registered engineer or design professional with special expertise applicable to portion of Work involved.

4. Delegated design work shall be constructed in compliance with building codes and regulations in effect and shall be fit and proper for intended use.

5. Delegated design work shall include drawings, specifications, and calculations prepared, stamped, and signed by qualified professional licensed or registered engineer licensed in the Project location as appropriate to design-build work.

    a. Plans, specifications, and calculations shall be acceptable to Owner, Owner's Representative, and applicable authorities.

C. Where required by Owner Contractor shall submit copies of current insurance policies covering errors and omissions of persons designing delegated design work with deductibles and limits per occurrence as mutually agreed by Owner and Contractor.

1. Provide endorsement to insurance providing for 30-day notice to Owner prior to cancellation or material reduction in coverage.

2. Insurance shall be maintained for not less than applicable statute of limitations for claims of latent defects, if such insurance is not written on an occurrence basis during time delegated design work is designed and constructed.

D. Review proposed layouts with Design Team and with various trades prior to commencing work related to delegated design work.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Description of Project management and coordination including but not necessarily limited to the following:

1. General Project coordination procedures.
2. Coordination drawings.
3. Staff names.
4. Administrative and supervisory personnel.
5. Project meetings.

B. Related Sections:

1. Section 01 30 00: Administrative requirements.
2. Section 01 79 00: Demonstration and training.

1.2 COORDINATION

A. Coordination: Coordinate construction operations included in various Specifications sections to ensure efficient and orderly installation of each part of Work.

1. Coordinate construction operations that depend on each other for proper installation, connection, and operation.

2. Coordinate work to assure efficient and orderly sequence of installation of construction elements.

3. Make provisions for accommodating items installed by Owner or under separate contracts.

B. Prepare memoranda for distribution to each party involved as needed, outlining special procedures required for coordination.

1. Include required notices, reports, and list of attendees at meetings; include Architect and Owner in distribution.

C. Verify characteristics of interrelated operating equipment are compatible; coordinate work having interdependent responsibilities for installing, connection to, and placing such equipment in service.

D. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings.

1. Follow routing shown for pipes, ducts, and conduits as closely as possible; make runs parallel with lines of building.

2. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated, coordinate locations of fixtures and outlets with finish elements.

F. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other construction activities and activities of other contractors to avoid conflicts and ensure orderly progress of Work.

1.3 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings for areas where space availability is limited and necessitates maximum utilization of space for components and where separate entities, products, and materials require coordination.

1. Require each subcontractor with items located in ceiling space to furnish coordination drawings of their items to assist in preparation of Contractor’s Coordination Drawings.

2. Indicate relationship of components shown on separate Shop Drawings.

3. Indicate required installation sequences.

4. Ceiling Spaces: Take special care to coordinate structure, ceiling systems, equipment located in ceiling spaces, fire protection systems, mechanical systems, and electrical systems.

B. Staff Names: Immediately after receipt of notice to proceed or immediately after signing of Contract by Owner and Contractor, submit list of principal staff assignments, including superintendent and other personnel in attendance at Project site.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.4 SUPERVISORY AND ADMINISTRATIVE PERSONNEL

A. Provide supervisory personnel, in addition to Project Superintendent, as required for proper and timely performance of Work and coordination of subcontracts.

B. Provide administrative staff as required to allow Project Superintendent and supervisory personnel to allocate maximum time to Project supervision and coordination.

1.5 PROJECT MEETINGS

A. Schedule and administer Project meetings throughout progress of Work:

1. Pre-construction meeting.
2. Progress meetings at weekly intervals.
3. Pre-installation conferences.
4. Coordination meetings.
5. Special meetings.

B. Make physical arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within two days to Architect, Owner, participants, and those affected.

C. Attendance: Job superintendent, major subcontractors, and suppliers as appropriate to agenda; Architect, Owner, and Owner and Architect's consultants as appropriate to agenda topics for each meeting.

D. Suggested Agenda: Review of Work progress, status of progress schedule and adjustments, delivery schedules, submittals, requests for information, maintenance of quality standards, pending changes and substitutions, and issues needing resolution.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes general quality control requirements.

1. General quality control.
2. Manufacturers' field services.
3. Mock-ups.
4. Independent testing laboratory services and inspections.

B. Related Requirements:

1. Refer to applicable codes and Specifications sections for test requirements.

1.2 QUALITY CONTROL, GENERAL

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.3 MANUFACTURERS' FIELD SERVICES

A. When specified in respective Specification sections require manufacturer or supplier to have qualified personnel to provide on-site observations and recommendations.

1. Observe field conditions, including conditions of surfaces and installation.
2. Observe quality of workmanship.
3. Provide recommendations to assure acceptable installation and workmanship.
4. Where required, start, test, and adjust equipment as applicable.

B. Representative shall submit written report to Architect and Owner, listing observations and recommendations.

1.4 MOCK-UPS

A. Erect field samples and field mock-ups at locations on site as approved in advance and in accordance with requirements where included in Specifications section.

1. Test mock-ups requiring special equipment may be erected at location having access to necessary equipment. Coordinate with Architect.

B. Field samples and mock-ups not approved and not capable of being acceptably revised shall be removed from site.

C. Approved field samples and mock-ups may be used as part of Project.

1.5 TESTING LABORATORY SERVICES AND INSPECTIONS

A. Testing laboratory services and inspections specified and required by applicable codes and regulations will be performed by firms independent of firms related to construction operations and shall be acceptable to applicable authorities.

1. Notify Owner immediately where potential conflict of interest may be involved with testing laboratories or inspection services for Project.

2. Owner or Architect may also require independent testing of items where doubts exist that product or system does not conform to Contract Documents.

3. Owner will employ and pay for testing laboratory and special inspectors to provide Project specific testing and inspections under applicable codes and Specification sections except where indicated otherwise.

a. Owner employment of testing laboratory and inspectors shall not relieve Contractor of obligation to perform Work in accordance with requirements of applicable codes and Contract Documents.

1) Laboratory and inspectors may not release, revoke, alter, or enlarge on requirements of Contract Documents.

b. Retesting required because of non-conformance to specified requirements shall be performed by Owner's testing laboratory.

1) Payment for retesting shall be charged to Contractor by deducting inspection and testing charges from Contract amount.

c. Owner provided testing shall be limited to Project specific testing and shall not include general tests or approvals of materials, equipment, or systems.

d. Owner-provided inspections shall be limited to Project design team inspections and special inspectors required by applicable authorities.

B. Perform services in accordance with requirements of governing authorities and with specified standards.

C. Reports will be submitted to Architect in duplicate giving observations and results of tests and inspections, indicating compliance or non-compliance with specified standards and with Contract Documents.

1. Where required, testing laboratory and inspectors will submit copy of tests and inspections directly to enforcing agency.

D. Contractor shall cooperate with testing laboratory and inspection personnel; furnish tools, samples of materials, design mix, equipment, storage, and assistance as requested.

1. Notify Owner, Architect, inspectors, and testing laboratory sufficiently in advance of expected time for operations requiring inspection and testing services.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes temporary construction facilities and temporary controls.

1. Electricity and lighting.
2. Heat and ventilation.
3. Water and sanitary facilities.
4. Construction aids.
5. Temporary enclosures.
6. Barriers.
7. Cleaning during construction.
8. Project identification.
9. Field offices.
10. Cellular telephone service.
11. Storage.

B. Related Requirements:

1. Section 01 70 00: Progress cleaning and final cleaning.
2. Section 01 74 10: Waste management.

C. Provide temporary construction facilities and temporary controls as required to conform to applicable authorities and as required to complete Project in accordance with Contract Documents.

1. Authorities: Contact governing authorities to establish extent of temporary facilities and temporary controls required by authorities.

2. Building Manager: Contact Building Manager to establish extent of temporary facilities and temporary controls required by building management.

1.2 ELECTRICITY AND LIGHTING

A. Provide electrical service required for construction operations, with branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.

1. Connection to existing electrical service is permitted.

2. Owner will pay costs of energy used from existing on-site services.

3. Provide separate metering and reimburse Owner for costs of energy used from existing on-site services.

B. Provide lighting for construction operations.

1. Permanent lighting may be used during construction; maintain lighting and make routine repairs.

C. Owner will pay costs of energy used from existing on-site services.

D. Provide separate metering and reimburse Owner for costs of energy used from existing on-site services.

1.3 HEAT AND VENTILATION

A. Provide heat and ventilation as required to maintain specified conditions for construction operation, to protect materials and finishes from damage due to temperature and humidity.

B. Coordinate use of existing facilities with Owner.

1. Supplement with temporary units as required to maintain specified conditions for construction operations, and to protect materials and finishes from damage due to temperature or humidity.

C. Owner will pay costs of energy used from existing on-site services.

1.4 WATER AND SANITARY FACILITIES

A. Provide water service required for construction operations; extend branch piping with outlets located so water is available by use of hoses.

1. Connection to existing facilities is permitted.

2. Owner will pay for water used from existing on-site services.

B. Provide and maintain required sanitary facilities and enclosures.

1. Existing facilities shall not be used.

2. Where existing sanitary facilities are designated to be used during construction operations maintain in sanitary condition. Verify availability with Building Management prior to beginning on-site work.

1.5 CONSTRUCTION AIDS

A. Noise, Dust and Pollution Control: Provide materials and equipment necessary to comply with local requirements for noise, dust, and pollution control.

B. Fire Protection: Maintain on-site fire protection facilities as required by applicable authorities and insurance requirements.

C. Security: Protect Site and Work; prevent unauthorized entry, vandalism, and theft.

1. Coordinate with Owner’s security program.

D. Dewatering: Provide and operate drainage and pumping equipment; maintain excavations and site free of standing water.

E. Use of Existing Facilities: Verify availability of existing facilities for construction operations with Owner prior to beginning on-site construction.

1. Existing stairs shall not be used.

2. Designated existing stairs may be used by construction personnel, coordinate with Owner.

3. Existing elevators shall not be used.

4. Designated elevators may be used, coordinate use with Owner; provide protective coverings for finish surfaces of elevator cars and entrances.

1.6 ENCLOSURES

A. Temporary Closures: Provide temporary weather-tight closures for exterior openings for acceptable working conditions, for protection for materials, to protect interior materials from dampness, for temporary heating, and to prevent unauthorized entry.

1. Provide doors with self-closing hardware and locks.

B. Temporary Partitions: Provide temporary partitions as required to separate work areas from occupied areas, to prevent penetration of dust and moisture into occupied areas, and to prevent damage to existing areas and equipment.

1. Construction: Framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces; Flame Spread Rating of 25 in accordance with ASTM E84.

2. Paint surfaces exposed to view in occupied areas.

1.7 BARRIERS

A. Barriers: Provide barriers as required to prevent public entry to construction areas and to protect adjacent properties from damage from construction operations.

1. Fence: Provide minimum 8-foot-high commercial grade chain link or painted solid wood fence around construction site; equip with gates with locks.

2. Covered Walkways: Provide lighted covered painted walkways as required by authorities having jurisdiction for public rights-of-way and for public access to existing building.

B. Barricades: Provide barricades as required by governing authorities.

C. Tree Protection: Provide barriers around trees and plants designated to remain; protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.

1.8 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish. Recycle or dispose of off-site.

B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

1.9 PROJECT IDENTIFICATION

A. Project Sign: Provide minimum 32-square foot Project identification sign of wood frame and exterior grade plywood construction, painted, with computer generated graphics by professional sign maker.

1. Design: As furnished by Architect.

2. Submit to Owner and Architect additional names or changes proposed to Project sign for prior written approval.

3. Erect on site at location established by Architect.

B. Other Signs: Subject to approval of Architect and Owner.

1.10 FIELD OFFICES

A. Field Office: Provide weather-tight field office, with lighting, electrical outlets, data outlets, heating, and ventilating equipment, and equipped with furniture.

1. Meeting Space: In addition, provide space for Project meetings with table and chairs to accommodate minimum six persons.

2. Telephone Service: Provide telephone service to field office.

3. Multi-Purpose Copier: Provide plain paper multi-purpose color and black-and-white copier with enlargement and reduction capability and with built-in printer, scanner, and facsimile capabilities.

4. Computer: Provide desktop computer system at Project field office with e-mail capacity and software compatible with Architect word processing system; including e-mail line and internet capabilities.

a. Digital Camera/Cellular Telephone: Maintain operational digital camera or comparable cellular telephone on-site during construction.

1.11 CELLULAR TELEPHONE SERVICE

A. Cellular Telephone Service: Furnish on-site Project Managers with cellular telephone with high quality digital camera capacity. Ensure Owner and Architect ability to contact site during construction operations.

1. Schedules: Submit schedules of on-site Project Managers with individual cellular telephone numbers to Owner and Architect; maintain schedules and cell phone numbers up to date during Project on-site operations.

1.12 STORAGE

A. Storage for Tools, Materials, and Equipment: Limit on-site storage to Project area; provide weather-tight storage, with heat and ventilation for products requiring controlled conditions.

1. Maintain adequate space for organized storage and access.

2. Provide lighting for inspection of stored materials.

1.13 REMOVAL

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion Inspection.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Restore existing facilities used during construction to specified or original condition.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes basic product requirements governing material and equipment.

1. General product requirements.
2. Product list.
3. Quality assurance.
4. Delivery, storage, and handling.

B. Related Requirements:

1. Section 01 25 00: Substitution procedures.
2. Section 01 30 00: Submittal of manufacturers' certificates.
3. Section 01 77 00: Operation and maintenance data.

1.2 GENERAL PRODUCTS REQUIREMENTS

A. Products include material, equipment, and systems.

B. Comply with Specifications, referenced standards, and applicable codes and regulations as minimum requirements.

C. Provide new materials except as specifically allowed by Contract Documents.

D. Materials to be supplied in quantity within a Specification section shall be by one manufacturer, shall be the same, and shall be interchangeable.

E. Provide equipment and systems composed of materials from a single manufacturer except where otherwise recommended by equipment or systems manufacturer or where otherwise indicated in Contract Documents.

F. Manufacturers: Manufacturers listed in Specifications, on Drawings, on Schedules, and in Notes, which shall be considered acceptable to extent their products comply with Contract Documents requirements and are suitable for applications indicated.

1. Manufacturer’s representative shall be responsible for reviewing Contract Documents and verifying their specified products conform to Contract Documents, applicable codes, and regulations, and are suitable for applications indicated.

a. Where specified products are not recommended by manufacturer’s representative, immediately notify Architect.

b. Where a different product by same manufacturer is recommended by manufacturer’s representative as more suitable for applications indicated, immediately notify Architect.

2. Basis of Design: Following shall be considered as Basis of Design.

    a. Specific manufacturers and products identified in Specifications as Basis of Design.

    b. Specific manufacturers and products listed in Schedules.

    c. Specific manufacturers and products listed on Drawings or in Notes.

    d. Where more than one manufacturer or product is listed as Basis of Design, immediately notify Architect and request clarification.

        1) Where more than one manufacturer or product is listed as Basis of Design in one location in Contract Documents clearly indicating either is acceptable, no clarification would be necessary.

G. Contractor's Options: Comply with following options; requests for substitutions for named manufacturers and products shall comply with requirements specified in Section 01 25 00 – Substitution Procedures.

1. Products Identified by Reference Standards: Select product meeting referenced standard for products specified only by reference standard.

    a. Requests for Substitutions to be limited to products not complying with referenced standards.

        1) Submit justification for non-compliance with reference standards as part of Request for Substitutions; if product is foreign made submit rationale why foreign standards and basic materials indicate compliance.

2. Named Manufacturers: Where names of manufacturers are specified select any named manufacturer product meeting Specifications for products specified by naming one or more manufacturers.

    a. Submit Request for Substitution for any manufacturer not named.

3. Named Manufacturers and Named Products: Select any named manufacturer named product meeting Specifications for products specified by naming one or more manufacturers and products.

    a. Where only one manufacturer and product are named, together with additional manufacturers without specific products, Requests for Substitutions to be limited to products not comparable to that specified.

        1) Contractors, subcontractors, suppliers, and manufacturers shall take special care to ensure comparable products are being supplied based on design, performance, quality, and longevity.

        2) Substitutions: Submit Request for Substitution for any manufacturer not named and for products not comparable to those specified in design, performance, quality, and longevity.

4. Basis of Design: Where manufacturer or manufacturer and product both are indicated as Basis of Design, submit Request for Substitution for other manufacturers and products.

5. “Or Equal” Clauses: Submit request for substitution for manufacturer or product not specifically named in Specifications where terms "or equal", "or approved equal", or similar references are made.

H. Nameplates: Do not attach or imprint manufacturer or producer nameplates on exposed surfaces in occupied spaces except for required labels and operating data.

1. Equipment Nameplates: Provide permanent nameplate on service connected and power operated equipment located on easily accessible surface inconspicuous in occupied spaces.

a. Provide name of product and manufacturer, model and serial number, capacity, speed, rating, and similar information.

1.3 SUBMITTALS

A. Product List: Within 35-days after award of Contract, submit to Owner and Architect a complete list of major products proposed for installation, with name of manufacturer, trade name, and model.

B. Product List: Prior to submittal of second Request for Payment, submit to Architect complete list of major products which are proposed for installation, with name of manufacturer, trade name, and model.

1. Tabulate products by Specification number and title.

C. Substitutions: Refer to Section 01 25 00 – Substitution Procedures.

1.4 QUALITY ASSURANCE

A. Comply with industry standards and applicable codes except when more restrictive tolerances or requirements indicate more rigid standards or precise workmanship.

B. Perform work by qualified people to produce workmanship of specified quality.

C. Install products straight, true-to-line, and in correct relationship to adjacent materials, with hairline joints, free of rough, sharp, and potentially hazardous edges.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1. Seismic Anchors: Conform to code requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transport products by methods to avoid product damage, deliver in undamaged condition in manufacturer's unopened containers or packaging.

B. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.

C. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

F. Arrange storage to provide access for inspection; periodically inspect to assure products are undamaged and are maintained under required conditions.

G. Provide equipment and personnel to handle products by methods to prevent soiling and prevent damage.

H. Promptly inspect shipments to assure products comply with requirements, quantities are correct, and products are undamaged.

I. Immediately remove from Project products damaged, wet, stained, and products with mold and products with mildew.

1. Take special care to prevent absorbent products such as gypsum board and acoustical ceiling units from becoming wet.

END OF SECTION

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes execution requirements.

1. Installer qualifications.
2. Examination.
3. Manufacturer's instructions.
4. Installation.
5. Cleaning.
6. Protection.

B. Related Requirements:

1. Section 01 50 00: Cleaning during construction.
2. Section 01 77 00: Closeout procedures.
3. Section 01 79 00: Demonstration and training.

1.2 INSTALLER QUALIFICATIONS

A. Experienced Installers: Installers shall have minimum five years' successful experience installing items like those required for Project, except for individuals in training under direct supervision of experienced installer.

1.3 EXAMINATION

A. Acceptance of Conditions: Beginning installation of a product signifies installer has examined substrates, areas, and conditions for compliance with manufacturer requirements for tolerances and other conditions affecting performance.

B. Field Measurements: Take field measurements as required to fit Work properly; recheck measurements prior to installing each product.

1. Where portions of Work are to fit to other construction verify dimensions of other construction by field measurements before fabrication; allow for cutting and patching to avoid delaying Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically in Drawings.

1.4 MANUFACTURERS' INSTRUCTIONS

A. Manufacturer’s Recommendations: When work is specified to comply with manufacturers' recommendations or instructions, distribute copies to persons involved and maintain one set in field office.

1. Conform to requirements specified in Section 01 30 00 for submittal of recommendations or instructions to Architect; submit to Architect only where specified or where specifically requested; otherwise keep in Field Office.

B. Perform work in accordance with details of recommendations and instructions and specified requirements.

1. Consult with Architect should a conflict exist between Specifications and recommendations, or Specifications and instructions.

C. Where manufacturer's information notes special recommendations in addition to installation instructions, comply with both recommendations and instructions.

1.5 INSTALLATION

A. Pre-Installation Meetings: Installers and suppliers are to attend pre-installation meetings scheduled by Contractor.

B. Comply with manufacturers’ written recommendations and installation instructions unless more restrictive requirements are specified.

C. Locate Work and components accurately, in correct alignment and elevation.

1. Make vertical work plumb and horizontal work level.

2. Install components to allow space for maintenance and ease of removal for replacement.

D. Install products at time and under conditions to ensure best possible results; maintain conditions required for product performance until Substantial Completion.

E. Conduct operations so no part of Work is subject to damaging operations or excessive loads during normal conditions.

F. Securely anchor permanent construction in place, accurately located and aligned with other portions of Work.

G. Allow for building movement including thermal expansion and contraction.

H. Make joints of uniform width; arrange joints as indicated, for best visual effect where not otherwise indicated; fit exposed connections together to form hairline joints except where otherwise indicated.

1.6 CLEANING

A. Cleaning During Construction: Specified in Section 01 50 00 - Temporary Facilities and Controls.

B. Progress Cleaning: Keep installed areas clean using nontoxic cleaning materials specifically recommended by manufacturers of product being cleaned, where not otherwise recommended use nontoxic materials that will not damage surfaces.

1. Remove debris from concealed spaces before enclosing space.

2. Supervise construction operations to assure no part of construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

C. Final Cleaning: Execute final cleaning at Substantial Completion.

1. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces.

a. Vacuuming Equipment: Type with high efficiency particulate arrestor (HEPA) type filters; properly maintained.

2. Clean equipment and fixtures to a sanitary condition, clean filters of mechanical equipment, replace filters where cleaning is impractical.

a. Clean ducts.

3. Clean site; sweep paved areas.

4. Remove waste, surplus materials and rubbish from Project and site; recycle to maximum extent feasible.

1.7 PROTECTION

A. Protect products subject to deterioration with impervious cover. Provide ventilation to avoid condensation and trapping water.

B. Take care to use protective covering and blocking materials that do not soil, stain, or damage materials being protected.

C. After installation, provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.

D. Protect interior materials from water damage; immediately remove wet materials from site to prevent growth of mold and mildew on site.

END OF SECTION

SECTION 01 73 00

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Contractor is responsible for cutting, fitting, and patching to complete Work and to:

1. Make its parts fit together properly.
2. Uncover work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to Contract Documents.
5. Remove samples of installed work as required for testing.
6. Provide routine penetrations of non-structural surfaces for installation of piping.
7. Provide routine penetrations of non-structural surfaces for installation of conduit.

B. Related Requirements:

1. Section 01 50 00: Temporary facilities and controls.
2. Section 02 41 00: Structure demolition.
3. Section 02 41 20: Selective building demolition for remodeling.

1.2 SUBMITTALS

A. Submit written request well in advance of cutting or alteration which affects:

1. Work of Owner or separate contractor.
2. Structural value or integrity of any element of Project.
3. Integrity of weather-exposed or moisture-resistant elements.
4. Efficiency, operational life, maintenance, or safety of operational elements.
5. Visual qualities of sight-exposed elements.

B. Request shall include:

1. Identification of Project and description of affected work.
2. Necessity for cutting or alteration.
3. Effect on work of Owner or separate contractor.
4. Effect on structural integrity, or weatherproof integrity of Project.
5. Alternatives to cutting and patching.
6. Cost proposal, when applicable.
7. Written permission of separate contractor whose work will be affected.
8. Description of proposed work including:

    a. Scope of cutting, patching, alteration, or excavation.
    b. Products proposed to be used.
    c. Extent of refinishing to be included.

C. Should conditions of Work or schedule indicate a change of products from original installation, Contractor shall submit request for substitution as specified in Section 01 25 00 – Substitution Procedures.

D. Submit written notice to Architect designating date and time work will be uncovered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with Specifications and standards for each specific product involved.

B. Where Specifications and standards have not been provided, provide materials and fabrication consistent with quality of Project and intended for commercial construction.

C. Provide new materials for cutting and patching unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to Architect in writing; do not proceed with work until Architect has provided further instructions.

3.2 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of Work.

1. Provide services of licensed engineer for designing temporary support where required by applicable authorities for temporary supports and for shoring; submit engineering calculations directly to applicable authorities upon request.

B. Protect other portions of Project from damage.

3.3 PERFORMANCE

A. Execute cutting by methods that provide proper surfaces to receive installation of repairs and finishes.

1. Execute excavating and backfilling by methods which will prevent settlement, and which will prevent damage to other work.

B. Employ same installer or fabricator to perform cutting and patching work as employed for new construction for:

1. Weather-exposed or moisture resistant elements.
2. Sight-exposed finished surfaces.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

D. Restore work that has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.

E. Fit work tight to pipes, sleeves, ducts, conduit, and penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes:

1. For continuous surfaces, refinish to nearest intersection.
2. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01 74 10

WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Project requires special Waste Management Program.

1. Effect optimum control of solid wastes.
2. Prevent environmental pollution and damage.

B. Related Work:

1. Section 01 50 00: Temporary facilities and controls.
2. Section 01 81 15: *CAL*Green environmental requirements.

1.2 DEFINITIONS

A. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively.

B. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste, including construction, remodeling, repair, and demolition operations.

C. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair, and demolition operations.

1. Rubbish: Includes both combustible and noncombustible wastes, such as paper, boxes, glass, crockery, metal and lumber scrap, tin cans, and bones.

2. Debris: Includes both combustible and noncombustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.

D. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.

E. Sanitary Wastes:

1. Garbage: Refuse and scraps resulting from preparation, cooking, distribution, or consumption of food.

2. Sewage: Domestic sanitary sewage.

1.3 SUBMITTALS

A. Waste Management Program: Comply with Contract Documents and applicable code requirements for salvaging, recycling, and disposing of nonhazardous waste.

1. Prior to commencement of Work, schedule and conduct meeting with Owner and Architect to discuss proposed Waste Management Program.

2. Develop mutual understanding relative to details of recycling, and rebate programs.

3. Prepare and submit a written and graphic Waste Management Program including, but not limited to, the following:

a. Indicate procedures to be implemented.

b. Estimate total Project waste to be generated, and estimated cost of disposing of Project waste in landfills.

c. Estimate total cubic yards of following waste to be diverted from landfill.

1) Clean dimensional wood, palette wood.
2) Plywood, oriented strand board, and medium density fiberboard.
3) Cardboard, paper, packaging.
4) Other items as directed by Owner and Architect.

d. Estimate amounts of following waste in appropriate units (weight, feet, square yards, gallons).

1) Metals.
2) Gypsum board.
3) Carpet.
4) Paint.
5) Other items as directed by Owner and Architect.

e. Submit permit or license and location of waste disposal areas.

f. Submit procedures for recycling/re-use program.

g. Submit procedures for rebate programs.

h. Revise and resubmit Waste Management Program as required by Owner and Architect.

1) Review of Contractor's Waste Management Program will not relieve Contractor of responsibility for control of pollutants and other environmental protection measures.

B. Submit summary of solid waste generated by Project with each application for progress payment, on form acceptable to Owner and Architect; include manifests, weight tickets, receipts, and invoices identifying Project and waste delivered to following locations.

1. Recycling Centers.
2. Class III landfills.

3. Inert fills.

C. Prepare rebate information and product documentation as required for Owner to qualify for rebate programs; submit with final closeout submittals.

1. Where feasible submit in electronic format, otherwise in three-ring binder.

1.4 RECYCLING PROGRAM

A. Recycling: Implement recycling program that includes separate collection of waste materials of following types as applicable to Project requirements; recycling program to be applied by Contractors and subcontractors.

1. Land clearing debris.
2. Asphaltic concrete.
3. Concrete.
4. Masonry materials.
5. Ferrous metal.
6. Non-ferrous metal.
7. Clean dimensional wood and palette wood.
8. Plywood, oriented strand board, and medium density fiberboard.
9. Paper - bond.
10. Paper - newsprint.
11. Cardboard and paper packaging materials.
12. Glass.
13. Plastics.
14. Gypsum board (unpainted).
15. Paint.
16. Rigid foam.
17. Carpet and pad.
18. Beverage containers.
19. Porcelain plumbing fixtures.
20. Insulation.
21. Others as appropriate.

B. Handling: Keep materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

1. Clean materials contaminated prior to placing in collection containers.

2. Arrange for collection by or delivery to appropriate recycling center or transfer station that accepts construction and demolition waste for purpose of recycling.

C. Participate in Re-Use Programs: Rebates, tax credits, and other savings obtained for recycled or re-used materials shall accrue to Contractor.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes Contract closeout procedures.

1. Substantial Completion.
2. Final Completion.
3. Project record documents.
4. Material and finish data.
5. Operation and maintenance manuals.

B. Related Requirements:

1. Section 01 30 00: Administrative requirements including attic stock.
2. Section 01 78 00: Warranties.
3. Section 01 79 00: Demonstration and training.

1.2 SUBSTANTIAL COMPLETION

A. Immediately prior to Substantial Completion, schedule agency reviews as required for “temporary certificate of occupancy” or for “certificate of occupancy”.

B. When Contractor considers Work, or a designated portion thereof is substantially complete, submit written notice, with list of items to be completed or corrected.

1. List (“Punch List”): Format pre-approved by Owner and Architect; tabular form with each space listed required.

C. Within a reasonable time, Owner and Architect will inspect status of completion and may add to “Punch List”.

D. Should Owner and Architect determine Work is not substantially complete, Contractor will be promptly notified in writing, giving reasons.

E. Contractor shall remedy deficiencies and send a second written notice of substantial completion; Architect will reinspect Work.

1. Contractor shall pay for Architect's time and direct expenses where more than one Substantial Completion inspection is required.

F. When Work is determined to be substantially complete by Architect, a Certificate of Substantial Completion will be prepared in accordance with General Conditions.

1.3 FINAL COMPLETION

A. When Work is complete, submit written certification indicating:

1. Work has been inspected for compliance with Contract Documents.

2. Work has been completed in accordance with Contract Documents and deficiencies listed (in 'Punch List") with Certificate of Substantial Completion have been corrected.

3. Equipment and systems have been tested in presence of Owner's representative and are operational.

4. Work is complete and ready for final inspection.

B. Special Submittals: In addition to submittals required by Contract, submit following.

1. Provide submittals required by governing authorities to governing authorities with copies included in Project Record Documents.

2. Submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

3. Electronic Format: Provide Documents in both printed and digital formats acceptable to Owner.

1.4 PROJECT RECORD DOCUMENTS

A. Keep documents current; do not permanently conceal any work until required information has been recorded.

1. Owner will provide Contractor with a separate set of Drawings to maintain for Project Record Documents.

2. Store reproducible Drawings, one set of Project Manual, and one copy of each Change Order separate from documents used for construction, for use as Project Record Documents.

3. Indicate actual work on Drawings; indicate actual products used in Project Manual, including manufacturer, model number and options.

4. Update Project Record Documents daily and allow for Architect inspection at least once a month.

B. At Contract close-out submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

C. As-Built Documents: General Contractor shall have electronic "As Built" sets of Contract Documents (Project Drawings and Project Specifications) prepared prior to Final Completion.

1. Contractor shall use one complete electronic set of Contract Documents (Drawings and Specifications) for use for "As-Builts".

2. As-Built Drawings: Revise Drawings based on Record Documents and field measurements made after installation and indicate actual locations of structural elements, ducts, piping, wiring, and equipment.

    a. Professional draftspersons experienced in electronic media used for Contract Documents shall revise original Project Drawings based on information recorded on Project Record Documents.

3. As-Built Specifications: Revise Specifications to indicate manufacturers who provided materials specified along with specifics indicating accessories, options, and finishes used in Project.

    a. Cross referencing Submittal records is acceptable for accessories only.

4. Review Submittal: Submit two copies of electronic media of “As-Built” Documents to Architect for review.

    a. After Architect review, revise where indicated and submit final electronic media to Owner.

D. Final Completion Submittal: At Project Completion submit both Project Record Documents and As-Built Documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1. Electronic Format: Provide Project Record Documents and As-Built Documents in both printed and digital formats acceptable to Owner.

E. Final Completion Submittal: At Project Completion submit both Project Record Documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1. Electronic Format: Provide Project Record Documents in both printed and digital formats acceptable to Owner.

1.5 MATERIAL AND FINISH DATA

A. Provide data for primary materials and finishes.

B. Arrange by Specification division and give names, addresses, and telephone numbers of subcontractors and suppliers. List:

1. Trade names, model, or type numbers.
2. Cleaning instructions.
3. Product data.
4. Maintenance recommendations.

C. Electronic Format: Provide Material and Finish Data in both digital and printed formats acceptable to Owner.

1. Printed Format: Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Provide manuals for:

1. Electrically operated items.
2. Electrical equipment and controls.
3. Maintenance manuals provided as part of Submittals.
4. Emergency manuals and instructions provided as part of Submittals.

B. Provide a separate volume for each system, with a table of contents and index tabs for each volume.

C. Arrange by Specification division and gives names, addresses, and telephone numbers of Subcontractors and suppliers. List:

1. Appropriate design criteria.
2. List of equipment and parts lists.
3. Operating and maintenance instructions.
4. Shop drawings and product data.

D. Electronic Format: Provide Operation and Maintenance Manuals in both digital and printed formats acceptable to Owner.

1. Printed Format: Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.

END OF SECTION

SECTION 01 78 00

WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Warranties: Compile required, and incidental warranties required by Contract Documents.

1. Manufacturer Warranties: Provide manufacturer's standard warranties where specified including inspections and services included or required as part of manufacturer's standard warranty.

2. Special Warranties: Provide special warranties as required by Specifications sections.

3. These warranties shall be in addition to and not a limitation of other rights Owner may have against Contractor under Contract Documents, and which may be prescribed by law, regardless of wording of warranty.

B. Extended Correction Period: Contractor shall correct failure of materials and systems to perform in a manner consistent with their intended use including but not limited to failure of waterproofing and roofing systems to resist penetration from water.

1. Standard Correction Period: One year after Substantial Completion or Beneficial Occupancy by Owner except where otherwise noted in Contract Documents; coordinate with General Conditions and Supplementary Conditions.

a. Items used by Contractor during construction operations shall not be considered substantially completed.

b. Correction of Work Period begins with Owner occupancy not completion of component.

2. Extended Correction Period: Requirements are same as standard correction period but for an extended period as indicated in Specifications sections.

3. Contractor Responsibilities: Bear cost of correcting failed work and replacing construction damaged by failure of materials and systems to perform in a manner consistent with their intended use during correction period.

a. Requirements for correction period shall apply to Subcontractors, suppliers, installers, and those responsible for failed work.

b. Owner and Design Team shall not be responsible for determining degree of responsibility of those involved.

4. Owner's Rights under Law: Correction period shall be in addition to and not a limitation of other rights Owner may have against Contractor under Contract Documents, and which may be prescribed by law.

1.2 FORM OF SUBMITTAL

A. Special Warranty and Extended Correction Period Forms: Provide duplicate copies, notarized or on Contractor and Manufacturer's letterhead without conditions or exceptions to requirements specified.

1. Assemble documents executed by subcontractors, installers, suppliers, and manufacturers.

2. Provide table of contents and assemble in binder with durable plastic cover, clearly identified regarding extent of contents.

3. Electronic Format: Submit USB 3.0 flash drives of warranties, in Microsoft Word.

B. Manufacturer Warranty Forms: Use manufacturer’s standard forms unless otherwise directed in Contract Documents; completed form shall not detract from or confuse interpretations of Contract Documents.

1. Manufacturer’s authorized representative shall sign manufacturer warranties.

2. Subcontractor and installer shall countersign warranty where specified.

3. Warranties for waterproofing and roofing systems shall be countersigned by subcontractor and installer.

C. Submit final warranties prior to final application for payment.

1. For equipment put into use with Owner's permission during construction, submit within ten days after first operation.

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

D. Provide information for Owner's personnel regarding proper procedure in case of failure and instances that might affect validity of manufacturer warranty.

1.3 WARRANTIES AND CORRECTION OF WORK DOCUMENTS

A. Warranties and Correction of Work Documents are intended to protect Owner against failure of work and against deficient, defective, and faulty materials and workmanship, regardless of sources.

B. Limitations: Warranties and correction of work requirements are not intended to cover failures that result from:

1. Unusual or abnormal phenomena of the elements.
2. Owner's misuse, maltreatment, or improper maintenance of work.
3. Vandalism after substantial completion.
4. Insurrection or acts of aggression including war.

C. Related Damages and Losses: Remove and replace work which is damaged as result of failure, or which must be removed and replaced to provide access for correction of work.

D. Reinstatement: After correction of work reinstate warranty or extended correction period for corrected work to date of original expiration, but not less than half original period.

1. Correction of Work Period: The general correction of work period specified shall not be extended by corrective work except to extent required to correct failure and repair or replace materials damaged by failure.

E. Replacement Cost: Replace or restore failing items without regard to anticipated useful service lives where part of correction of work period, extended correction of work period, and special warranty period unless otherwise noted.

F. Rejection of Warranties: Owner reserves right to reject unsolicited and coincidental product warranties that detract from or confuse interpretations of Contract Documents.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide equipment and systems demonstration and instruction in accordance with Contract Documents.

1. Video record seminars and system demonstrations.

B. Related Sections:

1. Section 01 31 00: Project management and coordination.
2. Section 01 77 00: Contract closeout procedures.
3. Refer to Facility Services Subgroups for mechanical and electrical requirements.

1.2 DESCRIPTION

A. Seminar Agenda and Outline:

1. Prepare a seminar agenda and outline in consultation and cooperation with Owner. Include following:

a. Equipment and systems that will be included in seminars.
b. Name of companies and representatives presenting at seminars.
c. Outline of each seminar's content.
d. Time and date allocated to each system and item of equipment.

2. Submit preliminary seminar agenda and outline for review and comment by Owner.

a. Revise and resubmit agenda and outline until all seminar requirements have been satisfied and seminar dates and presenters have been finalized.

3. Submit final seminar agenda and outline no later than eight weeks before date of Acceptance of Work.

B. Seminar Organization:

1. Contractor’s presentation leaders shall chair seminars.

a. Coordinate qualification of training personnel, seminar contents, and presentations with Owner.

2. Coordinate individual presentations and ensure manufacturers’ representatives scheduled to be at training seminars are present.

3. Arrange for presentation leaders familiar with design operation, maintenance and troubleshooting of equipment and systems.

    a. Where one person is not familiar with all aspects of equipment or system; arrange for specialists familiar with each aspect.

4. Coordinate proposed seminar dates with Owner and select mutually agreeable dates.

5. Video Recording: Arrange for video recording (audio and video) of training seminars and system demonstrations, including seminar and demonstration questions and answers.

C. Seminar Content:

1. Architect’s Consultants will explain design philosophy of primary systems.

2. Include following information in presentations dealing with specific systems.

    a. An overview of how system is intended to operate.
    b. Describe design parameters, constrains and operational requirements.
    c. Describe system operation strategies.
    d. Provide information to help in identifying and troubleshooting problems.

3. Include following information in presentations dealing with equipment.

    a. Explanation of how equipment operates.
    b. Recommended preventative and routine maintenance.

D. System Demonstration:

1. Demonstrate operation of equipment and systems when specified in individual technical sections. Include following in demonstration.

    a. Start-up and shut down.
    c. Operation.
    d. Scheduled and preventative maintenance.
    e. Troubleshooting.

2. Demonstration may be conducted at time of original starting with Owner's prior approval.

E. Seminar and Demonstration Questions:

1. Be prepared to answer questions raised by Owner’s personnel at demonstrations and seminars.

2. If unable to satisfactorily answer questions immediately, provide written response within three days.

F. Use manufacturer’s operation and maintenance data as basis of instruction.

1.3 SUBMITTALS

A. Video Recording: Submit three copies of each video recording in DVD format acceptable to Owner; include label on each DVD and on each container identifying Project and Seminar content.

END OF SECTION

SECTION 01 81 15

*CAL*GREEN ENVIRONMENTAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Comply with *CAL*Green environmental requirements as adopted by authorities having jurisdiction and indicated on *CAL*Green Check Lists.

1. Mixed-Use Projects: Comply with specific *CAL*Green requirements for mixed-use projects adopted by applicable authorities.

B. Related Sections:

1. Section 01 74 10: Waste management.
2. Section 01 81 15: *CAL*Green environmental requirements.

1.2 ENVIRONMENTAL REQUIREMENTS

A. Mandatory Measures: Comply with *CAL*Green Mandatory Measures applicable to Project; comply with Voluntary Tier requirements where indicated applicable to Project.

1. Design team and construction team are each required to participate to maximum degree possible to achieve *CAL*Green environmental requirements.

2. Contract Documents are not intended to limit alternative means of achieving environmental requirements.

a. Suggestions from Contractor, subcontractors, suppliers, and manufacturers for achieving environmental requirements are encouraged; team approach is also encouraged.

3. Voluntary Tiers: Construction team is encouraged to work with Owner and Design Team to achieve enhanced Voluntary Tier levels by incorporating additional measures as defined in *CAL*Green Appendixes.

a. Construction team is encouraged to work with Owner and Design Team to incorporate additional measures as defined in *CAL*Green Appendixes.

b. Contact Owner and Architect regarding extent of intent of Project to reach Voluntary Tiers, additional work necessary to achieve enhanced Voluntary Tiers, and potential costs involved in achieving each Voluntary Tier.

c. Construction team is required to achieve Mandatory Measures and Voluntary Tiers as applicable, and to achieve as much as possible without unacceptable cost impact or schedule impact as determined by Owner.

B. Requirements: Construction team is required to review *CAL*Green requirements relative to Project related to but not necessarily limited to following.

1. Energy Efficiency: Comply with California Energy Commission requirements.

2. Water Efficiency and Conservation: Comply with requirements for both indoor and outdoor water use.

3. Material Conservation and Resource Efficiency:

    a. Nonresidential Projects: Provide weather-resistant exterior wall and foundation envelope including prevention of landscape irrigation spray on structures (if any) and prevent water intrusion at exterior entries.

    b. Residential Projects: Seal openings and penetrations in building envelope Construction Waste:

    c. Construction Waste: Provide construction waste management plan as defined by *CAL*Green and complying with *CAL*Green requirements for construction waste diverted from landfill by recycling or salvage for reuse.

    d. Nonresidential Projects Building Maintenance and Operation: Provide for commissioning requirements as required by *CAL*Green including but not limited to testing, documentation, and training, testing and adjusting.

    e. Residential Projects Building Maintenance and Operation: Provide operation and maintenance data as required by *CAL*Green.

4. Nonresidential Projects Environmental Quality: Comply with following as adopted by authorities having jurisdiction and as applicable to Project.

    a. Fireplaces: Comply with requirement for fireplaces (if any) to be direct-vent sealed-combustion gas type or sealed wood-burning fireplace, woodstove, or pellet stove.

    b. Mechanical Equipment Pollution Control: Cover duct and related air distribution component openings to prevent dust and debris accumulation.

    c. Finish Material Pollution Control: Comply with *CAL*Green requirements for volatile organic compound (VOC) emissions including but not necessarily limited to following (as applicable):

        1) Adhesives, sealants, and caulks.
        2) Paints and coatings.
        3) Carpet, carpet cushion, and carpet adhesives.
        4) Resilient flooring systems.
        5) Composite wood products formaldehyde limitations.

    d. Filters: Comply with requirements for mechanically ventilated buildings to have air filtration media for outside and return air prior to occupancy.

    e. Environmental Tobacco Smoke (ETS) Control: Comply with *CAL*Green requirements for ETS.

    f. Interior Moisture Control: Comply with California Building Code requirements and *CAL*Green requirements for vapor retarder at concrete slab foundations and capillary break (aggregate base).

g. Building Material Moisture Content: Do not use water damaged building materials, remove and place wet and high moisture content insulation, and do not enclose wall or floor framing when moisture content exceeds 19%.

h. Indoor Air Quality: Comply with *CAL*Green requirements for outside air delivery and carbon dioxide monitoring.

i. Environmental Comfort: Comply with *CAL*Green requirements for whole acoustical control and interior sound control.

j. Outdoor Air Quality: Comply with *CAL*Green requirements for reduction of greenhouse gases and ozone depletion.

5. Residential Projects Environmental Quality:

a. Fireplaces: Comply with requirement that gas fireplaces (if any) shall be direct-vent sealed-combustion type and woodstoves or pellet stoves (if any) comply with U.S. EPA Phase II emissions limits.

b. Mechanical Equipment Pollution Control: Cover duct and related air distribution component openings to prevent dust and debris accumulation.

c. Finish Material Pollution Control: Comply with *CAL*Green requirements for volatile organic compound (VOC) emissions including but not necessarily limited to following (as applicable):

1) Adhesives, sealants, and caulks.
2) Paints and coatings.
3) Carpet, carpet cushion, and carpet adhesives.
4) Resilient flooring systems.
5) Composite wood products formaldehyde limitations.

d. Interior Moisture Control: Comply with *CAL*Green requirements for vapor retarder at concrete slab foundations and capillary break (aggregate base).

e. Building Material Moisture Content: Do not use water damaged building materials, remove and place wet and high moisture content insulation, and do not enclose wall or floor framing when moisture content exceeds 19%.

f. Indoor Air Quality: Provide humidistat-controlled bathroom exhaust fans with Energy Star compliance, ducted to terminate outside building.

g. Environmental Comfort: Comply with *CAL*Green requirements for whole house exhaust fan louvers to be insulated or have covers which close when fan is off, and with heating and air-conditioning system design requirements.

C. Planning and Design: Construction team shall coordinate with Design Team regarding Project Planning and Design methods related to *CAL*Green requirements related to Project design and shall comply with requirements related to construction.

1.3 QUALITY ASSURANCE

A. Project Management and Coordination: Contractor to identify one person on Contractor's staff to be responsible for *CAL*Green issues compliance and coordination.

1. Experience: Environmental project manager to have experience relating to *CAL*Green building construction.

2. Responsibilities: Carefully review Contract Documents for *CAL*Green issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to environmental issues; and oversee Project Environmental Goals.

a. Submittals: Collect, compile, verify, and maintain sufficient information for submittals indicating compliance with applicable *CAL*Green requirements.

3. Meetings: Discuss *CAL*Green Goals at following meetings.

a. Pre-construction meeting.
b. Pre-installation meetings.
c. Regularly scheduled job-site meetings.

B. *CAL*Green Issues Criteria: Comply with requirements listed in *CAL*Green and various Specification sections.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General Issues: Do not use materials with moisture stains or with signs of mold or mildew.

1. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site.

2. Mold and Mildew: Materials that have evidence of growth of molds or of mildew are not acceptable, including both stored and installed materials; immediately remove from site.

2.2 SUBSTITUTIONS

A. Substitutions Environmental Issues: Requests for substitutions shall comply with requirements specified in Section 01 25 00 – Substitution Procedures, with following additional information required where environmental issues are involved.

1. Indicate each proposed substitution complies with *CAL*Green requirements.

2. Owner and Architect reserve right to reject proposed substitutions where *CAL*Green information is not provided and where substitution may impact mandatory requirements or Project voluntary tier requirements.

PART 3 - EXECUTION

3.1 PROTECTION

A. Environmental Issues: Protect interior materials from water damage; where interior products not intended for wet applications are exposed to moisture, immediately remove from site.

1. Protect installed products using methods that do not support growth of molds and mildews.

2. Immediately remove from site materials with mold and materials with mildew.

END OF SECTION

SECTION 024100 – DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Removal of designated construction.

B. Identification of utilities.

C. Demolition requirements.

1.2 RELATED SECTIONS

A. Division 01 Sections, as applicable.

1.3 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Accurately record actual locations of capped utilities and subsurface obstructions.

1.4 REGULATORY REQUIREMENTS

A. Perform work of this Section under provisions of CBC Chapter 33, CFC Chapter 14, and NFPA 241 for demolition work, safety of structure, dust control and safety of occupants.

B. Obtain required permits from authorities.

C. Do not close or obstruct egress width to exits.

D. Do not disable or disrupt building fire or life safety systems without three-day prior written notice to Owner.

E. Conform to procedures applicable when discovering hazardous or contaminated materials

1.5 SCHEDULING

A. Schedule work under the provisions of Division 01.

B. Describe demolition removal procedures and schedule

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Provide, erect and maintain temporary barriers as required.

B. Erect and maintain temporary partitions to prevent spread of dust, odors and noise to adjoining facilities.

C. Protect existing materials and finishes that are not scheduled or otherwise required to be demolished.

D. Mark location of utilities.

3.2 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent and occupied buildings.

B. Maintain protected egress and access to the Work.

3.3 DEMOLITION

A. Disconnect, remove, cap and identify designated utilities within demolition areas.

B. Demolish in an orderly and careful manner. Protect existing supporting structural members and materials.

C. Except where noted otherwise, remove demolished materials from site. Do not bury or burn materials on site.

D. Remove demolished materials from site as Work progresses. Upon completion of Work, leave areas in clean condition.

E. Remove temporary Work.

END OF SECTION 024100

SECTION 02 41 10

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Demolish existing construction as required for Project.

1. Remove existing materials and equipment from site.
2. Remove foundations including basement floor slabs.
3. Cap and identify active utilities.
4. Remove buried tanks, including related inactive service lines.

B. Related Sections:

1. Section 01 11 00: Summary of work including hazardous materials requirements.
2. Section 01 50 00: Temporary facilities including barriers and waste management.
3. Section 01 74 10: Waste management.
4. Municipal Authorities: Dismantling, removing, and capping of Municipal utilities.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Do not interfere with use of adjacent buildings; maintain free and safe passage to and from.

2. Prevent movement or settlement of adjacent structures, provide and place bracing or shoring and be responsible for safety and support of structures. Assume liability for movement, settlement, damage or injury.

3. Cease operations and notify Architect immediately if safety of adjacent structures appears to be endangered; take precautions to properly support structures. Do not resume operations until safety is restored.

4. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement or collapse, promptly repair.

5. Obtain permission from adjacent property owners when outriggers, swinging cranes or similar equipment traverse their property.

B. Delegated Design: Provide special engineering to ensure compliance with applicable codes and Contract Documents for shoring.

C. Scheduling: Do not close or obstruct roadways without permits. Conduct operations with minimum interference to adjacent traffic.

1.3 SUBMITTALS

A. Action Submittals:

1. Submit demolition procedures and operational sequence to ensure Project sequencing is consistent with Owner needs.

B. Informational Submittal:

1. Submit copies of permits and notices authorizing demolition work.
2. Submit copies of certificates of severance of utility services.
3. Submit copies of permit for transport and disposal of debris.

C. Pre-Demolition Photographs: Show conditions of exiting adjacent construction and site improvements that might be misconstrued as damaged by demolition operations. Submit before work begins.

D. Delegated Design Certificates: Submit certification signed by California licensed structural engineer indicating shoring compliance with code requirements.

E. Sustainability Certification Points: Submit information and certifications necessary to for *CAL*Green compliance.

1.4 SITE CONDITIONS

A. Structures to be demolished shall be evacuated and their use discontinued before start of work.

B. Arrange and pay for disconnecting or removing, capping and plugging utility services; disconnect and stub off; notify affected utility company in advance and obtain approval before starting Work.

C. Place markers to indicate location of disconnected services; identify service lines and capping locations on Project Record Documents.

D. Maintain access to existing walkways, exits, and adjacent occupied facilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Debris: Maintain possession of materials being demolished except where noted as a material for reinstallation or a material to be retained by Owner. Immediately remove debris from site.

B. Materials for Reinstallation: Carefully remove, store and protect materials indicated to be reinstalled. Contact Owner and Architect prior to beginning demolition to determine extent of other materials that might be suitable for reinstallation.

1. Inventory and record condition of items to be reinstalled.

C. Owner Retained Materials: Contact Owner prior to beginning demolition to determine extent of materials to be retained. Carefully remove materials indicated to be retained by Owner; deliver and store where directed.

1. Inventory and record condition of items to be retained by Owner.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Demolish structures and appurtenances in an orderly and careful manner.

1. Tanks: Remove tanks within construction area; pump out buried tanks located outside construction area, fill tanks with sand or fine gravel and cover with fill unless otherwise indicated.

B. Perform demolition in accordance with authorities having jurisdiction.

1. Do not use explosives.

C. Keep work sprinkled to prevent dust; provide hoses and water as required for demolition. Coordinate potential availability of water from existing on-site water sources with Owner; do not use on-site water without prior written approval.

D. Remove demolished materials from site, unless otherwise directed.

1. Burning materials on site is not permitted.

2. Remove from site, contaminated, vermin infested, or dangerous materials encountered and dispose of by safe means so as not to endanger health of workers or public.

E. Rough grade areas affected by demolition and leave level to within one percent; maintain grades and contours of site as indicated.

1. Backfill over excavated areas, open pits and holes caused as a result of demolition which exceed excavation limits for project; use approved fill.

F. Remove demolished materials, tools and equipment upon completion of work; leave site in condition acceptable to Architect.

3.2 REPAIR

A. Repair damage to adjacent structures caused as result of demolition.

B. Repair demolition beyond that required for Project.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing.

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

C. Section 04 20 00 - Unit Masonry: Reinforcement for masonry.

D. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

E. Section 05 31 00 - Steel Decking: Placement of steel anchors in composite decking.

F. Section 05 50 00 - Metal Fabrications: Placement of embedded steel anchors and plates in cast-in-place concrete.

G. Section 32 13 13 - Site Concrete: Sidewalks, curbs and gutters.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary.

B. ACI PRC-347 - Guide to Formwork for Concrete.

C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials.

D. ACI SPEC-301 - Specifications for Concrete Construction.

E. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

F. PS 1 - Structural Plywood.

G. CBC Chapter 19A.

1.4 DEFINITIONS

A. Unexposed Finish: A general-use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.

B. Exposed Finish: A general-use finish applicable to all formed concrete exposed to view and including surfaces which may receive a paint coating (if any).

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials and installation requirements.

1. Form release agent.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.6 QUALITY ASSURANCE

A. Industry Standard: Formwork design and construction shall be in accordance with ACI SPEC-301, ACI CODE-318, and ACI PRC-347.

B. Maintain one copy of each installation standard on site throughout the duration of concrete work.

C. Regulatory Requirements: Conform to formwork construction requirements of the California Building Code (CBC) Title 24, Part 2, Chapter 19A as amended and adopted by authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 - PRODUCTS

2.1 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Chamfer outside corners of beams, joists, columns, and walls.

D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

E. Comply with relevant portions of ACI CODE-318, ACI PRC-347, and ACI SPEC-301.

F. Provide materials for contact with concrete which impart suitable surface quality to completed concrete. Use the following form types:

1. Forms for Exposed Finish Concrete:
    a. Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces.
    b. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on the Drawings.
2. Forms for Unexposed Finish Concrete:
    a. Plywood, lumber, metal, or another acceptable material.
    b. Provide lumber dressed on at least two edges and one side for tight fit.
    c. When unexposed concrete is intended to receive waterproofing, provide form as for exposed finish concrete.

G. Provide materials to construct formwork to support forming materials in contact with concrete, of sufficient capacity to withstand pressures of concrete placement and to support concrete in place until cured, without distortion.

2.2 WOOD FORM MATERIALS

A. Plywood for Architectural Concrete: Marine Grade, APA B-B Plyform Class 1.
   1. APA proprietary concrete form panels designed for high reuse.
   2. HDO for very smooth concrete finish, in Structural I, and with special overlays.
   3. Bond Classification: Exterior. Common Performance Categories: 19/32, 5/8, 11/16, 23/32, 3/4.

B. Softwood Plywood for Concealed Surfaces: PS 1,undamaged face C Grade, Group 2 Plugged EXT or APA Structural I Sheathing.

C. Hardboard: For curved surfaces, tempered hardboard, Masonite Corp., or equal.

D. Lumber: Douglas fir or douglas fir-larch species; appropriate for intended use grade; with grade stamp clearly visible.
   1. Sound and undamaged straight edges, and solid knots, to maintain principal shores to support concrete until minimum strength is achieved as approved by Structural Engineer.

E. Embedded Nailers: Clear all heart redwood or pressure preservative-treated (PPTDF) douglas fir, edges reverse beveled to key into concrete.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable, adjustable-length or snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
   1. Do not use materials containing diesel oil or petroleum-based compounds.
   2. Does not impair subsequent treatments of concrete surfaces or bond of applied coatings.
   3. Products:
      a. Kaufman Products Inc; FormKote Emulsion: www.kaufmanproducts.net/#sle.
      b. Nox-Crete Inc; BIO-NOX: www.nox-crete.com/#sle.
      c. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/#sle.
      d. W. R. Meadows, Inc; Duogard II (water-based): www.wrmeadows.com/#sle.
      e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.
   1. Thickness: 0.125 inch
   2. Compression Resistance, ASTM D695: 5,500-8,000 PSI.
   3. Products:

a. BoMetals, Inc: www.bometals.com/#sle.
b. Sika Corporation; Speed Dowel: usa.sika.com
c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

E. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 50 00.

F. Screed Pins and Chairs:
1. Provide units that leave no metal closer than 1-1/2 inch to the plane of the exposed concrete surface.
2. Manufacturers:
a. Grann Adjustable Quick Screed (800/554-7266).
b. Dayton Richmond (800/745-3700).
c. Aztek (877/531-3344).
d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 SYSTEM REQUIREMENTS

A. Formwork Design Requirements: Formwork products and execution specified herein are for finish surface quality only.
1. Design, layout and construction of formwork shall be solely the responsibility of the Contractor.
2. Design and construct formwork, shoring and bracing to conform to California Building Code (CBC), Title 24, Part 2, Chapter 19A requirements and ACI CODE-318.
3. Resulting concrete shall conform to shapes, lines and dimensions indicated and required.

B. Coordination:
1. Coordinate Work specified in this Section with other Sections which require placement of embedded products and provision of openings and recesses.
2. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from the Architect before proceeding.

3.3 EARTH FORMS

A. Earth (Soil) Forms, General: Except as otherwise indicated on Drawings, conform to ACI SPEC-301, ACI PRC-347, and California Building Code (CBC) requirements. Refer also to notes on Structural Drawings.

B. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing

concrete.

3.4 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301, ACI PRC-347, and California Building Code (CBC) Title 24, Part 2 requirements.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

1. Use form ties of sufficient strength and sufficient quantities to prevent formwork spreading.
2. Maintain principal shores to support concrete until minimum required strength is achieved.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

1. Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work.
2. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.

D. Align joints and make watertight. Keep form joints to a minimum. Make forms watertight to prevent leakage of concrete mortar. Locate form joints, at exposed concrete, to be symmetrical about center of panel, unless otherwise noted. Align joints symmetrically at exposed conditions.

E. Permanent openings: Provide openings to accommodate Work specified in other Sections. Size and locate openings accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.

F. Temporary openings: Provide temporary openings for cleaning and inspection. Provide drain openings at bottoms of formwork to allow water to drain. Locate temporary openings in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete Work.

G. Obtain approval before framing openings in structural members that are not indicated on drawings.

H. Coordinate this section with other sections of work that require attachment of components to formwork.

I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

J. Inspection: Before placing of concrete, and after placement of reinforcing steel in the forms, provide notification so that proper inspection can be made. Make such notification at least 2 working days in advance of placing concrete.

K. Rejection of Defective Work: Any movement or bellying of forms during construction or variations in excess of the tolerances specified shall be considered just cause for the removal of such forms and, in addition, the concrete

construction so affected. Reconstruct forms, place new concrete and required reinforcing steel at no additional cost to the District.

3.5 APPLICATION - FORM RELEASE AGENT

A. Form Release Agent: Provide either form materials with factory applied non-absorptive liner or field applied form coating to comply with applicable air quality regulations for VOC. If field applied coating is employed, thoroughly clean and recondition formwork and reapply coating before each use. Rust on form surfaces is not acceptable.

B. Apply form release agent on formwork in accordance with manufacturer's recommendations.

C. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

D. Do not apply form release agent where concrete surfaces to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.6 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

1. Install accessories in accordance with manufacturer's instructions and referenced standards, level, straight and plumb.

B. Locate and set in place items that are cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

1. Openings: Size and locate formed openings, depressions, recesses and chases to accommodate products to be applied to, built into and pass through concrete Work. Coordinate size, location and placement of inserts, embedded products, openings and recesses with Work specified in other Sections.

2. Anchors and Other Devices: Set and build into concrete formwork anchorage devices and other embedded products required for Work to be attached to or supported by concrete elements.

3. Locating Embedded Products and Openings: Use setting drawings, diagrams, instructions and templates to set embedded products.

4. Screeds: Set screeds and establish level for tops of concrete slabs and leveling for finish surfaces. Shape surfaces as indicated on the Drawings. Provide cradle, pad or base type screed supports for concrete over waterproof membranes and vapor retarders.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints are not apparent in exposed concrete surfaces.

3.7 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. At above grade forms, flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

C. Formwork Reuse: Do not reuse wood and plywood forming materials which contact concrete, except as follows:

1. High density plywood may be cleaned and reused for exposed concrete.
2. Unfaced plywood may be reused for concealed concrete.
3. Steel and fiberglass forming materials may be cleaned and reused.

D. Patching and Repairs: Patch tie holes with sheet metal patches and restore forms to like new condition prior to reuse.

3.8 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated.

1. Also as specified in ACI CODE-318, ACI SPEC-301, and ACI PRC-347, unless otherwise specified or indicated.

3.9 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

1. Comply with CBC Table 1705A.3, item 14.

C. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.10 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

1. Comply with California Building Code (CBC) requirements.
2. Formwork supporting weight of concrete may not be removed until concrete has reached a minimum of specified 28-day compressive strength and no earlier than 21 days after pour.
3. Removal of Load Bearing Formwork:

a. Do not remove shoring and forms supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, until concrete has attained its 28 day specified compressive strength, unless otherwise specified or permitted by the Structural Engineer of Record.

b. Determine the actual compressive strength has attained is adequate to support the weight of the concrete and superimposed loads.

c. Maintain curing and protection operations after form removal.

4. Removal of Non Load Bearing Formwork After Superimposed Loads or as Approved by Engineer:

a. Provided that concrete has hardened sufficiently, that it is not damaged, and has achieved sufficient strength to support its own weight and all imposed construction and design loads, forms not actually supporting weight of concrete or weight of soffit forms may be removed after concrete has cured at not less than 50 degrees F for 24 hours.

b. Maintain curing and protection operations after form removal.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

1. Remove formwork progressively so no unbalanced loads are imposed on structure. Remove formwork without damaging concrete surfaces.

2. Remove or snap off metal spreader ties inside wall surface. Cut nails and form ties off flush and leave surfaces level and clean.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.11 PATCHING

A. Schedule: Patch forming and tie holes immediately after form removal.

B. Cleaning: Clean surface of all loose materials and soiling.

C. Patching: Patch all holes and depressions with grouting gun and grout mix of one part cement and 2-1/2 parts mortar sand.

3.12 FORMWORK SCHEDULE

A. Footings and Walls, Not Exposed to View: Site fabricated plywood or lumber, coated with form release agent.

B. Footings and Walls, Exposed to View: Site fabricated plywood, coated with form release agent compatible with applied finish coatings.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.1 SECTION INCLUDES

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

B. Supports and accessories for steel reinforcement.

1.2 RELATED REQUIREMENTS

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

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

C. Division 26 - Electrical: Grounding connection to concrete reinforcement.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary.

B. ACI MNL-66 - ACI Detailing Manual.

C. ACI SPEC-301 - Specifications for Concrete Construction.

D. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

F. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

G. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

H. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

J. AWS A5.5/A5.5M - Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding.

K. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.

L. CRSI (DA4) - Manual of Standard Practice.

M. CRSI (P1) - Placing Reinforcing Bars, 10th Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Reinforcement supporting and spacing devices at exposed concrete only, to demonstrate non-corroding and non-staining characteristics.

2. Adhesive compounds.

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

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

E. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

F. Quality Control Submittals: Submit the following information related to quality assurance requirements specified:

1. Certifications: Submit to the testing laboratory mill test certificates for all reinforcing steel, showing physical and chemical analysis. If steel is to be welded, include in chemical analysis the percentages of carbon, manganese, copper, nickel, and chromium, and optionally the percentages of molybdenum and vanadium.

2. Certifications: If steel is to be welded, submit certifications to the testing laboratory signed by AWS Certified Welding Inspector (CWI) of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualification of welding operators, and qualification of welders.

G. Welding Procedure Specification Submittal: Submit to Testing Laboratory written Welding Procedure Specifications (WPS) as defined by AWS D1.4/D1.4M. The WPS shall be prepared by the Fabricator for review and approval by the Architect (Structural Engineer) and Testing Laboratory as complying with specified criteria, and shall be readily available to the welding inspector.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI CODE-318, ACI MNL-66, ACI SPEC-301, ASTM A184/A184M, and CRSI (P1).

1. Maintain one copy of each document on project site.

B. Regulatory Requirements: Conform to California Building Code (CBC) Title 24 Part 2, Chapter 19A requirements as amended and adopted by authorities having jurisdiction, for details of reinforcement.

C. Provide Architect, Project Inspector, and Special Inspector with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.4/D1.4M and no more than 12 months before start of scheduled welding work.

1. Only AWS Certified Welding Inspectors shall be used for tests and qualifications associated with welding of reinforcing steel.

2. Only AWS qualified welders or welding operators shall perform welding of reinforcing steel.

E. Coordinate Work specified in this Section with other Sections which require placement of embedded products and provision of openings and recesses.

F. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect (Structural Engineer) before proceeding.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver reinforcement bars new and free from rust and mill scale in original bundles marked with durable identification tags.

B. Storage: Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening coatings.

C. Handling: Take precautions to maintain reinforcement identification after bundles are broken.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Deformed billet-steel bars.
   2. Unfinished.

B. Reinforcing Steel: ASTM A706/A706M, Grade 60 (60,000 psi), deformed low-alloy steel bars.
   1. Unfinished.
   2. Carbon Content: 0.55 % maximum.

C. Reinforcing Steel: #3 Deformed bars, ASTM A615/A615M Grade 60 (420), Type A.

D. Tie Wire: ASTM A1064/A1064M steel wire, unfinished.

E. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Wire-bar-type devices, complying with CRSI (DA4), for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Sized and shaped for adequate support of reinforcement during concrete placement.
      a. Supports at Slab on Grade: Provide devices with load-bearing pads or horizontal runners where base material does not support chair legs, to prevent puncture of vapor retarder/barrier or provide precast concrete block bar supports of equal or greater strength to specified concrete.
      b. Corrosion Resistance:
         1) Provide stainless steel or plastic components for placement within 1-1/2 inches of weathering surfaces.
            (a) Provide plastic coated, plastic-tipped (CRSI, Class 1) or stainless steel types at exposed-to-view concrete surfaces.
            (b) Provide only stainless steel (CRSI Class 2) at exterior exposed surfaces to be painted.
   3. Welding Electrodes: AWS A5.5/A5.5M E80XX, low hydrogen, with a minimum yield point of 80,000 psi, for welding grade 60 reinforcing steel.

2.2 RE-BAR SPLICING:

A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing 160% of steel reinforcing design strength in tension and compression.

B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; Type II capable of developing 160% of steel reinforcing design strength in tension and compression.

C. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.3 FABRICATION

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

B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

C. Fusion welded reinforcing steel assemblies are not permitted.

D. Locate reinforcing splices not indicated on drawings at point of minimum stress. See Structural Drawings,

1. Review locations of splices with Architect (Structural Engineer) before fabrication and placement. .

PART 3 EXECUTION

3.1 PREPARATION

A. Cleaning: Clean reinforcement to remove loose rust and mill scale, soil, and other materials which may reduce or destroy bond with concrete.

B. Adjustment and Inspection: Do not bend or straighten reinforcement in a manner injurious to material. Do not use bars with kinks or bends not shown on Drawings and reviewed shop drawings, or bars with reduced cross-section due to corrosion or other cause.

C. Do not bend bars No. 5 and larger in the field.

D. Do not bend bars more than once in the same location.

3.2 PLACEMENT

A. General: Place and secure reinforcement as specified herein, as indicated and noted on Drawings and in compliance with recommended details and methods of reinforcement placement and support specified in CRSI Placing Reinforcing Bars.

B. Place, support and secure reinforcement against displacement. Do not deviate from required position.

1. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

C. Do not displace or damage vapor barrier.

D. Accommodate placement of formed openings.

E. Maintain concrete cover around reinforcing as indicated on Structural Drawings:

F. Comply with applicable code for concrete cover over reinforcement.
   1. If not otherwise indicated on Drawings or specified herein, provide concrete cover in compliance with ACI CODE-318.

G. Bond and ground all reinforcement to requirements of Division 26.

H. Coordination: Locate reinforcement to accommodate embedded products and formed openings and recesses.

I. Slab on Grade Reinforcement: Do not displace or damage vapor retarder/barrier at slab on grade.

J. Wire Reinforcement Placement: Place reinforcement in sheets as long as practicable, lapping adjoining pieces at least one full mesh and lace splices with 16 gage wire. Offset end laps in adjacent widths to prevent continuous laps. Extend reinforcement to within 1-inch of edge at slabs on grade. Cut mesh at expansion joints and full depth control joints.

K. Dowels: Secure tie dowels in place before depositing concrete. Provide No. 3 bars for securing dowels where no other reinforcement is provided.

L. Reinforcement Splices, General: Provide standard reinforcement splices by lapping ends, placing bars in contact and tightly wire tying. Comply with details and requirements of ACI CODE-318 for minimum lap of spliced bars and criteria indicated on the Drawings.
   1. Clearances for Splices: Wherever possible, provide minimum 1-1/2 inch clearance between sets of splices. Stagger horizontal bars so that adjacent spices are minimum 48 inches apart.

M. Reinforcement Supports: Support reinforcement on metal chairs, spacers or metal hangers to provide required coverage and to properly locate reinforcement. Do not use wood. Avoid cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
   1. Support Spacing: Space chairs and accessories in conformance with CRSI Placing Reinforcing Bars.

N. Welding of Reinforcement Steel
   1. Welding: Perform welding under continuous inspection and supervision of a qualified Registered Deputy Inspector employed by testing and inspection agency. Weld reinforcement as indicated on Drawings.
   2. If mill test report is not available, make chemical analysis of bars representative of bars to be welded. Bars with CE above 0.75 shall not be welded.
   3. No welds shall be made at bends in reinforcing bars. Welds to be 1 inch minimum from bends

O. Corrections During Concrete Placement: Maintain reinforcing steel workers on-site during placement of concrete for resetting reinforcement displaced by runways, workers and other causes.

3.3 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 40 00 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

1. Concrete floor slabs on grade are to be continuously inspected as recommended in the geotechnical report.

B. Inspector of Record, as specified in Section 01 45 33 - Code-Required Special Inspections and Procedures, will inspect installed reinforcement for conformance to contract documents before concrete placement.

1. Concrete floor slabs on grade are to be continuously inspected as recommended in the geotechnical report.

C. Defective Reinforcement Work: The following shall be considered defective and may be ordered to be removed and reconstructed at no change in Contract Time or Sum.

1. Bars with kinks or bends not shown on Drawings.
2. Bars injured due to bending or straightening.
3. Bars heated or bent.
4. Reinforcement not placed in accordance with Drawings and Specifications.
5. Rusty or oily bars.
6. Bars exposed in surface of concrete or without adequate concrete cover.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floors and slabs on grade.

B. Joint devices associated with concrete work.

C. Miscellaneous concrete elements, including equipment pads and thrust blocks.

D. Concrete curing.

1.2 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 03 35 11 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

D. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

E. Section 32 13 13 - Site Concrete: Sidewalks, curbs and gutters.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary.

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.

C. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

D. ACI 318 - Building Code Requirements for Structural Concrete.

E. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction.

F. ACI PRC-302.2 - Concrete Slabs that Receive Moisture-Sensitive Flooring Materials - Guide.

G. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

H. ACI PRC-305 - Guide to Hot Weather Concreting.

I. ACI PRC-306 - Guide to Cold Weather Concreting.

J. ACI PRC-308 - Guide to External Curing of Concrete.

K. ACI SPEC-301 - Specifications for Concrete Construction.

L. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

M. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

O. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens).

P. ASTM C111/C111M - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.

Q. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

R. ASTM C150/C150M - Standard Specification for Portland Cement.

S. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

T. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

U. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

V. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

W. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

X. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

Y. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

Z. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.

AA. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

BB. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

CC. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.

DD. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

EE. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

FF. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

GG. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

HH. ASTM D2103 - Standard Specification for Polyethylene Film.

II. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

JJ. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

KK. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

LL. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

MM. CBC - California Building Code.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

2. For membrane-forming, moisture emission-reducing, curing and sealing compound, provide manufacturer's installation instructions,.

C. Mix Design: Submit proposed concrete mix design.

1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 19 - Concrete: Design and Durability Requirements, and Chapter 26 - Construction Documents and Inspection.

a. Reports must include all the data as required to verify conformance with ACI CODE-318, Section 26.4.2.2, and the following:

1) Mix design identification number.

2) Cement certification.

3) Fly ash certification of compliance or test data.

4) Admixture data.

5) Aggregate test data.

3. Mix Designs Utilizing 15% Or More Fly Ash: Proportioning conform to ACI CODE-318, Section 26.4.3. Based on field experience or trial mixtures, or both, per ACI 318, Section
26.4. Proportioning per ACI 318, Section 26.4.2.2 (without field experience or trial mixtures) is not permitted.

4. Mix Design Review and Approval Process: An engineer from a DSA approved (LEA) testing laboratory shall review the mix design report and the design professional in responsible charge of the project shall approve the mix design.

a. Review by LEA Engineer: A qualified civil engineer associated with a DSA approved (LEA) testing laboratory shall review the report for conformance with ACI CODE-318, Sections 26.4.2.2. Issue an evaluation report of findings and recommendation for either acceptance or rejection and forward his report to the design professional in responsible charge of the project.

b. Approval by the Project Engineer in Responsible Charge: Based on the findings and recommendation of the LEA engineer’s evaluation report, the project design professional in responsible charge decides whether to accept or reject the mix design. He will issue a letter stating his acceptance or rejection. The letter shall be sent to DSA, and copied to the project inspector, the LEA laboratory, and the mix design engineer.

c. Documentation by the Concrete Supplier: The concrete supplier shall submit copies of the cement certification, fly ash certification of compliance or test data, admixture data, aggregate test data, and mix design identification number to the project inspector and the LEA engineer who reviewed the mix design report.

5. Indicate proposed mix design complies with admixture manufacturer's written recommendations.

6. Mix Design: Submit mix designs prepared, stamped and signed by a Civil Engineer licensed in the State of California.

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Samples: Submit two, 12 inch long samples of waterstops and construction joint devices.

F. Quality Control Submittals:

1. Field tests: Submit reports of all slump, strength and air content tests as required by authorities having jurisdiction and as indicated on the Drawings and specified herein.

2. Delivery tickets: Have available copies of delivery tickets complying with ASTM C94/C94M for each load of concrete delivered to site. Include on the tickets the additional information specified in the ASTM document.

G. Test Reports: Submit report for each test or series of tests specified.

H. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

I. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.

J. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

K. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

1. Maintain one copy of each document on site.

B. Follow recommendations of ACI PRC-305(305R) when concreting during hot weather.

C. Follow recommendations of ACI PRC-306(306R) when concreting during cold weather.

D. For slabs required to include moisture vapor reducing admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

E. For slabs indicated to receive membrane-forming, moisture emission-reducing, curing and sealing compound, do not proceed with application unless manufacturer's representative is present for every day of placement.

F. Regulatory Requirements:
   1. Conform to California Building Code (CBC) Chapter 19A requirement, as amended and adopted by authorities having jurisdiction.
   2. Chemical products field-applied to concrete shall comply with applicable air quality requirements of authorities having jurisdiction.
      a. Comply with Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions, CALGreen Section 5.504.4 Finish material pollutant control; 5.504.4.1 Adhesives, sealants and caulks; 5.504.4.3 Paints and coatings.
      b. Comply with CALGreen Section A5.405.4 Recycled content.
      c. Comply with CALGreen Section A5.406 Enhanced Durability and Reduced Maintenance.

G. Testing Agency Services: District will engage an independent testing and inspection agency to conduct tests and perform other services specified for quality control during construction, as required by Section(s) 01 40 00 - Quality Requirements and 01 45 33 - Code-Required Special Inspections and Procedures.

H. Coordination: Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories. Coordinate concrete requirements with Work specified for underground utilities and mechanical and electrical equipment pads and bases.

1.6 MOCK-UPS

A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish as result of formwork.
   1. Panel Size: Sufficient to illustrate full range of treatment.
   2. Number of Panels: Two.
   3. Locate as indicated on drawings.

B. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.

C. Mock-up may not remain as part of the Work.

1.7 DELIVERY AND HANDLING

A. Protection During Concrete Placement: Provide protective coverings and runways, and use appropriate equipment and means of access to Work areas to avoid soiling or damage to existing conditions.

B. Runoff: Prevent run off of water contaminated by construction agents and chemicals from soiling existing surfaces and from contaminating existing and future landscape areas.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Slabs with Porosity Inhibiting Admixture (PIA) or Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of the concrete.

C. Moisture Emission-Reducing Curing and Sealing Compound, Membrane-Forming: Provide warranty to cover cost of flooring delamination failures for 10 years.
   1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.
   2. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.

D. Moisture Emission-Reducing Curing and Sealing Compound, Penetrating: Provide non-prorated warranty to cover cost of flooring delamination failures for 20 years.
   1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.
   2. See Section 09 05 61 - Common Work Results for Flooring Preparation.

PART 2 PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.2 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 20 00.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type II/V
   1. Acquire cement for entire project from same

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.
   2. Fine and coarse aggregates, CBC Title 24, Part 2, 1903A.5, ACI CODE-318 Section 26.4.
   3. Other than Structural Concrete: Conform to requirements for structural concrete. source.

C. Fly ash and raw or calcined natural pozzolans to conform to ASTM C618 for Class N or F (Class C fly ash is not permitted). Per ASTM C618, sampling and testing of fly ash in accordance with ASTM C111/C111M.
   1. Conform to ACI CODE-318 Section 26.4.2.2 for the use of fly ash or natural pozzolan.
   2. Fly Ash: ASTM C618, Class N or F.
      a. Supply fly ash by an experienced producer that complies with all applicable standards above.
      b. Provide fly ash from one source for the duration of the project, unless additional physical testing of the changed mix is performed; per Concrete Mix Design.
   3. Calcined Pozzolan: ASTM C618, Class N.

D. Silica Fume: ASTM C1240, proportioned in accordance with ACI PRC-211.1.

a. Supply fly ash by an experienced producer that complies with all applicable standards above.

b. Provide fly ash from one source for the duration of the project, unless additional physical testing of the changed mix is performed; per Concrete Mix Design.

3. Calcined Pozzolan: ASTM C618, Class N.

D. Silica Fume: ASTM C1240, proportioned in accordance with ACI PRC-211.1.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.4 ADMIXTURES

A. The use of any chemical admixture is subject to prior approval by DSA.

B. Use no admixtures not included in mix design. Products of the following manufacturers are specified and will be acceptable provided they comply with referenced standards all other requirements of the Contract Documents:

C. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

D. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.

1. Products:

a. Euclid Chemical Company; ACCELGUARD 80: www.euclidchemical.com/#sle.

b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

E. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

1. Provide pigmented type, with ASTM C979/C979M inorganic pigments.

F. Water Reducing Admixture: ASTM C494/C494M Type A.

1. Products:

a. Euclid Chemical Company; EUCON NW: www.euclidchemical.com/#sle.

b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

G. Moisture Vapor Reducing Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs). Closes capillary systems formed during concrete curing to reduce moisture vapor emission and transmission. Reduces concrete shrinkage with no adverse effect on concrete properties or applied flooring.

1. Provide admixture in slabs to receive adhesively applied flooring or roofing.

2. Provide admixture in concrete for elevator pits, retaining walls, water-retaining structures, underground structures, roads, dams, and bridges.

3. VOC Content: Zero.

4. Installed admixture to meet or exceed Modified ASTM F1869 or ASTM F2170 testing to performance of moisture vapor emission rate (MVER) of 4 lbs/1,000 ft2/24 hours or lower.

a. Alternative test methods shall be acceptable to the finish flooring manufacturer and installer.

5. The concrete ready mix supplier must coordinate with the admixture

manufacturer before designing and testing any new mix designs, to receive guidance on achieving proper water absorption characteristics.

6. Products:
   a. AVECS, LLC; PRO-ACT: www.avecs.build/#sle.
   b. Barrier One Concrete Admixtures; MVRA-CPS: www.barrierone.com/#sle.
   c. Hycrete, Inc: www.hycrete.com/#sle.
   d. ISE Logik Industries, Inc; MVRA 900: www.iselogik.com/#sle.
   e. Specialty Products Group; Vapor Lock 20/20: www.spggogreen.com/#sle.
   f. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

2.5 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:
   1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.
   2. Performance Requirements:
      a. Comply with ACI PRC-302.1 and ACI PRC-302.2.
      b. Water Vapor Permeance: Not more than 0.010 perms, maximum.
         1) Permeance as tested after conditioning (ASTM E1745).
      c. Comply with ASTM E1745 Class A.
      d. Puncture Resistance, ASTM D1709: 2,300 gms.
   3. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   4. Products:
      a. Henry Company; Moistop Ultra 15: www.henry.com/#sle.
      b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
      c. Raven Industries; VaporBlock VB15, 15 mils thick (0.01 perms), Class A, unreinforced polyolefin: ravenefd.com,
      d. Reef Industries, Inc.; Vaporguard, 15 mil (E-96 0.000 perms), Class B: www.reefindustries.com
      e. Stego Industries, LLC; Stego Wrap Vapor Barrier, 15 mils:: www.stegoindustries.com/#sle.
      f. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
      g. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
   1. Grout: Comply with ASTM C1107/C1107M.
   2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:

a. Maximum: Plus 4 percent.
b. Minimum: Plus 1 percent.

3. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
4. Minimum Compressive Strength at 28 Days: 8,000 ponds per square inch.
5. Products containing aluminum powder are not permitted.
6. Flowable Products:
   a. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
   b. LATICRETE International, Inc; DURAGROUT: www.laticrete.com/#sle.
   c. SpecChem, LLC; SC Precision Grout: www.specchemllc.com/#sle.
   d. W. R. Meadows, Inc; 588-10K: www.wrmeadows.com/#sle.
   e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.
7. Low-Slump, Dry Pack Products:
   a. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
   b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

C. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, nonmetallic aggregate, and activator.
1. Composition: High solids content material exhibiting positive expansion when tested in accordance with ASTM C827/C827M.
   a. Maximum Height Change: Plus 4 percent.
   b. Minimum Height Change: Plus 1 percent.
2. Minimum Compressive Strength at 7 days, ASTM C579: 12,000 pounds per square inch.
3. Minimum Compressive Strength at 7 days, ASTM D695: 12,000 pounds per square inch.
4. Products:
   a. Euclid Chemical Company; E3-DEEP POUR: www.euclidchemical.com/#sle.
   b. Dayton Superior Corporation; __: www.daytonsuperior.com/#sle.
   c. Five Star Products, Inc; Five Star DP Epoxy Grout: www.fivestarproducts.com/#sle.
   d. W. R. Meadows, Inc; REZI-WELD 3/2: www.wrmeadows.com/#sle.
   e. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

2.6 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
1. Products:
   a. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com/#sle.
   b. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.
   c. W. R. Meadows, Inc; ACRY-LOK: www.wrmeadows.com/#sle.
   d. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

B. Epoxy Bonding System:
   1. Complying with ASTM C881/C881M and of Type required for specific application.
   2. Products:
      a. Adhesives Technology Corporation; CRACKBOND 2100 MV: www.atcepoxy.com/#sle.
      b. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com/#sle.
      c. Euclid Chemical Company; DURALFLEX GEL: www.euclidchemical.com/#sle.
      d. Euclid Chemical Company; DURALFLEX LV: www.euclidchemical.com/#sle.
      e. Euclid Chemical Company; DURAL 452 GEL, DURAL 452 LV, or DURAL 452 MV: www.euclidchemical.com/#sle.
      f. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
      g. Mapei Corporation; Planibond AE: www.mapei.com/#sle.
      h. Mapei Corporation; Planibond 3C: www.mapei.com/#sle.
      i. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000, or SpecPoxy 3000FS: www.specchemllc.com/#sle.
      j. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000: www.wrmeadows.com/#sle.
      k. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

C. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.
   1. Material: Closed-cell, non-absorbent, compressible polymer foam in sheet form.
   2. Products:
      a. W. R. Meadows, Inc; Deck-O-Foam Joint Filler with pre-scored top strip: www.wrmeadows.com/#sle.
      b. W. R. Meadows, Inc; X-Foam: www.wrmeadows.com/#sle.
      c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
   1. Products:
      a. W. R. Meadows, Inc; Speed-E-Joint: www.wrmeadows.com/#sle.
      b. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.
   1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
   2. Height: To suit slab thickness.

F. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.

2.7 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid

moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

1. Products:
    a. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
    b. Euclid Chemical Company ; EUCOBAR: www.euclidchemical.com/#sle.
    c. Nox-Crete Inc; Monofilm: www.nox-crete.com/#sle.
    d. SpecChem, LLC; SpecFilm Concentrate or SpecFilm: www.specchemllc.com/#sle.
    e. W. R. Meadows, Inc; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.
    f. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

B. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Clear, liquid sealer for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
    1. CONC-2.
    2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
    3. VOC Content: Less than 100 g/L.
    4. Solids Content: 25 percent, minimum.
    5. Products:
        a. Floor Seal Technology, Inc; VaporSeal 309 System: www.floorseal.com/#sle.
        b. Forta Corporation; ____: www.forta-ferro.com/#sle.
        c. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

C. Curing and Sealing Compound, High Gloss: Liquid, membrane-forming, clear, nonyellowing acrylic; complying with ASTM C1315 Type 1 Class A.
    1. Vehicle: Water-based.
    2. Solids by Mass: 25 percent, minimum.
    3. VOC Content: Ozone Transport Commission (OTC) compliant.
    4. Products:
        a. LATICRETE International, Inc; LUMISEAL FX: www.laticrete.com/#sle.
        b. Mapei Corporation; Mapecure UV WB: www.mapei.com/#sle.
        c. W. R. Meadows, Inc; VOCOMP-30: www.wrmeadows.com/#sle.
        d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Moisture-Retaining Sheet: ASTM C171.
    1. Curing paper, regular.
    2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.

E. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.

F. Water: Potable, not detrimental to concrete. ASTM C1602/C1602M per ACI CODE-318 Sec. 26.4.3.1

2.8 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations and ACI CODE-318.
   1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendation.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.

   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
   2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
   3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
   4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
   5. Water-Cement Ratio: As indicated on Structural Drawings.
   6. Maximum Slump: As indicated on Structural Drawings.
   7. Maximum Aggregate Size: See the table on Structural Drawing sheet S-0.1 Note 4.
      a. Structural Concrete: Maximum size not larger than 1/5 of narrowest dimension between forms, 1/3 depth of slab nor 3/4 of minimum clear spacing between individual reinforcing bars.
      b. Other than Structural Concrete: Conform to requirements for structural concrete.

2.9 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

C. Do not use shrinkage-reducing admixture (SRA) in same concrete batch with MVRA or PIA.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Layout construction and control joints according to the drawing details and plans following these guidelines:
   1. Finished exposed concrete floors are critical for aesthetics.

2. Layout joints on exposed concrete floors to allow for installation of utilities without sawcutting or concrete placement of different production batches subject to different colors. Staining and integral color concrete is not exempt from this requirement.
3. Architect to review joint pattern submittal each floor.
4. No lengthwise joints in corridors; place cross-corridor, if required.
5. Place joint at 90 degree wall corners.
6. Place joints at center line of columns.
7. Equally space all joints.

C. Verify that concrete cover requirements are met in formwork construction and reinforcement placement.

D. Examine areas to receive reinforced vapor retarders. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

E. Subbase: Per ACI PRC-302.1.
1. As indicated on Drawings and approved by the Geotechnical Engineer.
a. Minimum 4 inch thick (or larger) base of 1/2 inch or larger clean aggregate, per CA Green Code 4.505.2.1 and CBC 1907A.1.

F. Verify that base material (sand, gravel or natural as specified or indicated on Drawings) level, vapor barrier/retarder properly placed and that required clearances to reinforcing steel have been maintained.

G. Verify that all embedded products and formed openings and recesses are correctly placed.

H. At slabs on grade, verify that vapor retarder/barrier is properly placed and free of damage.

3.2 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Prepare previously placed concrete by cleaning with hydro-blasting or wet sand blasting to provide suitable surface for bonding. Provide minimum aggregate exposure of 1/4 inch.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
2. Use latex bonding agent only for non-load-bearing applications.

E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before

covering.

1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
    a. Install total thickness indicated on Drawings. Provide crushed rock, 1/2 inch grading, clean washed, complying with ASTM C33/C33M.
    b. Minimum 4 inch thick (or larger) base of 1/2 inch or larger clean aggregate, per CA Green Code 4.505.2.1 and CBC 1907A.1.
    c. Seam and Lap Sealing: With adhesive mastic and adhesive sealing tape, seal all seams, edges and penetrations of vapor retarder/barrier.
        1) For adhesive mastic seal, apply adhesive to both surfaces, allow approximately 10 minutes to set up and then press together smoothly and evenly, without gaps or fishmouths, for full contact bond.
        2) For adhesive tape seal, comply with manufacturer's instructions and recommendations.
        3) Seal all penetrations with both adhesive sealing tape and adhesive mastic.
        4) Seal sheets to concrete footing faces and penetrating components with adhesive mastic or double sided tape as recommended by membrane manufacturer.
2. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

3.3 CONCRETE MIXING

A. Concrete Mixing, General: Comply with ACI CODE-318 as adopted by CBC, Title 24, Part 2, Chapter 19A and ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete. Introduce and mix admixtures in compliance with manufacturer's instructions and recommendations.

3.4 PLACING CONCRETE

A. Notify District's Inspector and at least 2 working days in advance of placing concrete.

B. Place concrete in accordance with ACI PRC-304.

1. General: Comply with ACI CODE-318, as adopted by CBC, Title 24, Part 2, Chapter19A and as follows:
    a. Schedule continuous placement of concrete to prevent the formation of cold joints.
    b. Deliver ready mix concrete in accordance with ASTM C94/C94M. Place concrete within 90 minutes after start of mixing.
    c. Provide construction joints if concrete for a particular element or component cannot be placed in a continuous operation.
        1) Submit for review, proposed locations of joints prior to pouring. See Structural Drawings for additional requirements.
    d. Deposit concrete as close as possible to its final location, to avoid

segregation.

2. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.
    a. Consolidate concrete by means of mechanical vibrators, inserted vertically in freshly placed concrete in a systematic pattern at close intervals. Penetrate previously placed concrete to ensure that separate concrete layers are knitted together.
    b. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates.
    c. Do not use vibrators to move concrete laterally.

C. Hot Weather Placement: Comply with recommendations of ACI PRC-305 when ambient temperature before, during, or after concrete placement is expected to exceed 90 deg F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would otherwise exceed 0.2 lbs./SF/Hr..
    1. Use evaporation reducer.
    2. Do not add water to approved concrete mixes under any conditions.
    3. Provide mixing water at lowest feasible temperature, and provide adequate protection of poured concrete to reduce rate of evaporation.
    4. Use fog nozzle to cool formwork and reinforcing steel immediately prior to placing concrete.

D. Cold-Weather Placement: Comply with provisions of ACI PRC-306 when air temperature has fallen to or is expected to fall below 40 deg F. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
    1. Uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
    2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
    3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

E. Place concrete for floor slabs in accordance with ACI PRC-302.1.
    1. Schedule continuous placement and consolidation of concrete within planned construction joints.
    2. Place concrete in linear pattern, with control joints at slab on grade conditions only, with joints located as indicated on the Drawings.
    3. Thoroughly consolidate concrete without displacing reinforcement or embedded items, using internal vibrators, vibrating screeds, roller pipe screeds or vibrating laser screed as described below.
    4. Screeding Procedures: Strike off and level concrete slab surfaces before bleed water can collect on surface. Do not work concrete further until finishing operations are commenced.

a. Typical Slabs: Strike off and level surface using highway straight edges, darbies or bull floats.

b. Create control and construction joints true to line and profile. Do not radius the joints. Refer to the Drawings for structural requirements of joints.

c. Locate joints as indicated on the Drawings but in no case shall joint spacing exceed 15 feet or 36 times the slab thickness in both directions and maximum area between joints shall not exceed 200 square feet. Locate joints on column centers and at re-entrant corners where possible.

d. Sawcut control joints to one-quarter of slab depth, immediately after slab has achieved initial set and not longer than 8 hours. "Soff-Cut" method is preferred.

e. Alternate control and construction joint products and procedures will be considered in accordance with substitution provision specified in Section 01 60 00 - Product Requirements.

F. Notify Architect not less than 24 hours prior to commencement of placement operations.

G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

H. Ensure reinforcement, inserts, and waterstops will not be disturbed during concrete placement.

I. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

J. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.5 SLAB JOINTING

A. Locate joints as indicated on drawings.

1. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

1. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 92 00 for finish joint sealer requirements.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install where indicated and required on Structural Drawings, to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

2. Separate slabs on grade from vertical surfaces with joint filler.

3. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, or as

indicated.

a. Structural slab contact at foundation walls and grade beams shall be doweled as detailed.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 8 hours after placing; use 1/4 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

F. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.6 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for compliance with specified tolerances.

B. Maximum Variation of Surface Flatness:

1. Exposed Concrete Floors: 1/4 inch in 10 feet.
2. Under Seamless Resilient Flooring: 1/8 inch in 10 feet.
3. Under Carpeting: 1/4 inch in 10 feet.

C. For the following applications, depressions in slab floors between high spots shall be a maximum 1/8 inch in 10 ft., using a metal straight edge placed at any location on slab, and measured within 72 hours of pour.

1. Slabs receiving resilient athletic flooring as specified in Section 09 65 66 - Resilient Athletic Flooring.

D. Curbs:

1. Top of Curb: 1/4 inch in 10 ft, non-cumulative.
2. Side of Curb: 1/8 inch in 10 ft, non-cumulative, vertical and horizontal.

E. Correct the slab surface if tolerances are less than specified.

F. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.7 CONCRETE FINISHING

A. Repair surface defects, immediately after removing formwork.

1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting without damaging reinforcement. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.
2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

C. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:

1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include resilient flooring.
2. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.

3.8 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
    a. Spraying: Spray water over floor slab areas and maintain wet.
    b. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
3. Final Curing: Begin after initial curing but before surface is dry.
    a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
    b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of Work specified in other Sections, after such Work is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work. Us non-shrink grout where required or indicated.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and

foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

C. Provide free access to concrete operations at project site and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

E. Field Certifications: For all concrete, provide signed copy of batch plant's certificate stating quantity of each material, amount of water, admixtures, departure time and date accompanying each load of materials or concrete.

F. Field Tests of Concrete: Perform tests in accordance with applicable California Building Code requirements, ACI SPEC-301 and requirements of authorities having jurisdiction.

G. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

H. Compressive Strength Tests: ACI CODE-318, 26.12.2.1(a), ASTM C39/C39M, for each test, mold and cure a minimum of four concrete test cylinders. Project Inspector to obtain test samples each day, for every 50 cubic yards, 2,000 sq. ft. of slab or wall surface area, or less of each class of concrete placed. CBC 1905A.1.17

1. Take additional samples for 7-day compressive strength tests for of each class of concrete at the beginning of of concrete work or whenever the mix or aggregate is changed.
2. Test one cylinder at 7 days and two at 28 days after placement.
3. Maintain fourth cylinder to be tested at 56 days only if 28-day test fails to meet strength requirement.
4. Take one additional test cylinder during cold weather concreting and cure it at job site under same conditions as concrete it represents. Test cold weather cylinder at 28 days.
5. Comply with ACI CODE-318, 26.12.3 Acceptance Criteria for Standard-Cured Specimens.
    a. Strength level of a concrete mixture shall be acceptable if (1) and (2) are satisfied:
        1) Every average of any three consecutive strength tests equals or exceeds fc'.
        2) No strength test falls below fc' by more than 500 psi if fc' is 5000 psi or less; or by more than 0.10fc' if fc' exceeds 5000 psi.
    b. If either of the requirements of 26.12.3.1(a) is not satisfied, steps shall be taken to increase subsequent strength tests.

c. Requirements of 26.12.6 for investigating strength tests shall apply if the requirements of 26.12.3.1(a)(2) are not met.

I. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

J. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

K. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.11 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

1. Obtain repair details from Architect (Structural Engineer) and approved by DSA before proceeding.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.12 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

B. Protect concrete from marring and damage due to weather and construction activities.

1. Protective measures shall include providing temporary coverings, and be in accordance with Section 01 50 00 - Temporary Facilities and Controls, and shall prohibit all non-essential construction activities, including cleaning and maintenance of construction equipment.

2. In particular, protect concrete floor slabs from oil, paint and other products that might penetrate and degrade concrete surface.

END OF SECTION

SECTION 04 05 11

MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mortar for masonry.

B. Grout for masonry.

1.2 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.

1.3 REFERENCE STANDARDS

A. ASTM C91/C91M - Standard Specification for Masonry Cement.

B. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

D. ASTM C476 - Standard Specification for Grout for Masonry.

E. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

F. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.

G. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry.

H. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength.

I. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

J. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

K. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry.

L. DSA IR 17-13 - Batch Plant Inspection.

M. DSA IR 21-2 - Concrete Masonry Multi-Lift Grouting.

N. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

E. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1. Comply with provisions modified under the CBC.
2. Maintain one copy of each document on project site.

1.6 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 40 00 - Quality Requirements.

B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.

1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.

C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.

1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.8 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or CBC Chapter 21A, whichever is more stringent.

PART 2 PRODUCTS

2.1 MORTAR AND GROUT APPLICATIONS

A. Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site.

1. Exception: If a specified mix design is not available in a premixed dry package, provide equivalent mix design using standard non-premixed materials.

B. Mortar Mix Designs: ASTM C270, Property Specification.

1. Masonry below grade and in contact with earth: Type S.
2. Engineered Masonry: Type S.
3. Exterior, Loadbearing Masonry: Type S.

4. Interior, Loadbearing Masonry: Type S.

C. Grout Mix Designs:

1. Comply with CBC 2103A.3.
2. Bond Beams and Lintels: 2,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
    a. Course grout in all grouted cells of hollow unit masonry.
3. Engineered Masonry: Compressive strength at 28 days: as indicated on Drawings; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
    a. Course grout in all grouted cells of hollow unit masonry.

2.2 MATERIALS

A. All materials to conform to CBC, Section 2103A.

B. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

1. Type: Type S.
2. Color: Mineral pigments added as required to produce approved color sample.
3. Water repellent mortar for use with water repellent masonry units.
4. Manufacturers:
    a. Amerimix, an Oldcastle brand; AMX 400 Portland Lime Mortar Mix: www.amerimix.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

1. Type: Coarse.
2. Manufacturers:
    a. Amerimix, an Oldcastle brand; AMX 600 CG Coarse Fill Grout: www.amerimix.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

1. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).
2. Manufacturers:
    a. Davis Colors: www.daviscolors.com/#sle.
    b. Lambert Corporation: www.lambertusa.com/#sle.
    c. Solomon Colors: www.solomoncolors.com/#sle.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Water: Clean and potable.

F. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

G. Bonding Agent: Epoxy type.

H. Integral Water Repellent Admixture: Polymeric liquid admixture added to mortar at the time of manufacture.

1. Performance of Mortar with Integral Water Repellent:

a. Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours:

1) No water visible on back of wall above flashing at the end of 24 hours.

2) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.

3) No more than 25 percent of wall area above flashing visibly damp at end of test.

b. Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.

c. Compressive Strength: ASTM C1314; maximum 5 percent decrease.

2. Use only in combination with masonry units produced with integral water repellent admixture.

I. Water-Repellent and Efflorescence-Control Mortar Mixture: Blended emulsion additive used in water-penetration-resistant and efflorescence-controlled masonry mortar.

1. Products:

a. Master Builders Solutions; MasterPel Series: www.master-builders-solutions.com/en-us/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2.3 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.

D. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

E. Do not use anti-freeze compounds to lower the freezing point of mortar.

F. If water is lost by evaporation, re-temper only within two hours of mixing.

2.4 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

1. Comply with DSA IR 21-2.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

PART 3 EXECUTION

3.1 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

B. Plug clean-out holes for grouted masonry with block masonry units. Brace masonry to resist wet grout pressure.

3.2 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

B. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.

3.3 GROUTING

A. Use either single-lift or multi-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.

1. Comply with DSA IR 21-2.

B. Comform to CBC 2104A.1.3.5 and TMS 602.3.5

C. Single-Lift Grouting:

1. Comform to CBC 2104A.1.3.5.
2. Limit height of pours to 48 inches for 8 inch wide CMU.
    a. For 10 inch wide and larger nominal concrete masonry: 64 inches.
3. Limit height of masonry to 16 inches above each pour.
4. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
5. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

D. Multi-Lift Grouting:

1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
2. Hollow Masonry: Limit lifts to maximum 4 feet and pours to maximum height of 12 feet 8 inches for walls with a nominal thickness of less than 12 inches , and 16 feet for walls with a 12 inches or larger nominal thickness
3. Place grout for spanning elements in single, continuous pour.
4. Multi-Lift Grouting Per DSA IR 21-2:
    a. Provide a coarse grout consisting of a high-slump, flowable mix (considering weather conditions) conforming to ASTM C476 and other requirements in TMS
    402/602 Article 2.2 and 2.6B, with an approved admixture (used in strict accordance with the manufacturer’s material installation instructions) per CBC Section 2104A.1.3.5 Item 3.b.

1) Provide a submittal for each grout mix design, including admixtures, in accordance with TMS 402/602 Article 1.5 B.1.b and DSA IR 17-13: Batch Plant Inspection Section 2. The grout mix design shall identify the admixture(s) and the required amounts and/or proportions used in the mix and, if applicable, the amounts to be added at the site by the masonry contractor. The Special Inspector (SI) shall document the addition of the admixture(s) to the grout mix that occurs at the site. Where manufacturer's material installation instructions require preconstruction testing, the results of such testing shall be included in the mix design report for review and approval prior to construction.
2) For 8-inch concrete masonry walls, place all horizontal bars in a single vertical plane in order to provide for continuous and unobstructed vertical cells as required by subparagraph 3 below. Where two horizontal bars are specified at discrete locations, such as at chords or collectors, at least one bar shall align vertically with the bars below, and above where occurs.
3) All cells shall have clear "unobstructed" dimensions meeting the minimum clear grout space dimension requirements of (TMS 402/602) TMS 402, Table 3.2.1 and TMS 602, Table 6, including footnote 3 of both tables. The minimum required grout space dimensions of cells, containing electrical conduits, horizontal reinforcement, or any other horizontal obstruction in the plane of the wall, shall be increased by the diameter or width of the obstruction.
4) Use of open-end concrete masonry units is) preferred, wherever possible, and is required for masonry not laid in running bond. Use open-end bond beam units wherever possible to facilitate the horizontal flow of grout. Bond beam units are required at all horizontal bars to provide a minimum 3-inch-high by 3-inch-wide opening through all cross webs. This can be achieved through custom bond beam units, cutting webs of bond beam units, inverting the upper bond beam in two courses of bond beam units or other approved method.
5) Provide cleanouts in accordance with CBC Section 2104A.1.3.1.

E. When grouting is stopped for more than one hour, terminate grout minimum 1-1/2 inch, 2 inches maximum below top of upper masonry unit to form a positive key for subsequent grout placement.

F. Solid grout all cells and courses, no exceptions. Consolidate with 3/4 inch diameter mechanical vibrator inserted into each and every cell.

1. Reconsolidate after the block has absorbed some of the water in the grout, but before the grout has lost plasticity.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 40 00 - Quality Requirements.

B. Testing of mortar and grout: Conform to the requirements of CBC, Section 2105A.3 Mortar and grout tests.

C. Test and evaluate mortar in accordance with ASTM C780 procedures.
   1. Test with same frequency as specified for masonry units.
D. Test and evaluate grout in accordance with ASTM C1019 procedures.
   1. Test with same frequency as specified for masonry units.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

B. Section 04 05 11 - Masonry Mortaring and Grouting.

C. Section 05 50 00 - Metal Fabrications: Loose steel lintels and Fabricated steel items.

D. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.3 REFERENCE STANDARDS

A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.

B. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength.

C. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

D. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry.

E. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, mortar, and masonry accessories.

C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Maintenance Materials: Furnish the following for District's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1. Maintain one copy of each document on project site.
B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
D. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
E. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

1.7 MOCK-UPS

A. Construct a masonry wall as a mock-up panel sized 4 feet long by 4 feet high; include mortar, accessories, structural backup, reinforcement, wall openings, and flashings (with lap joint, corner, and end dam) in mock-up.
B. Locate where directed.
C. Obtain the Architect's acceptance of visual qualities of the mock-up before proceeding with masonry work. Mock-up shall be the standard for judging completed masonry work.
D. Mock-up may not remain as part of work.
   1. Do not alter, move or destroy mock-up until work is completed.
E. Sealer Test Panel: Test a minimum 4 ft. by 4 ft. area on each type of masonry. Use the manufacturer’s application instructions. Let test area protective treatment cure before inspection. Keep test panels available for comparison throughout the protective treatment project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
   1. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Manufacturers:

1. Basis of Design Product: Indicated on Drawings as manufactured by Angelus Block Co., or approved equal.
2. Angeles Block Co., Inc.: www.angelusblock.com.
3. Orco Block Co.: www.orco.com.
4. RCP Block and Brick: www.rcpblock.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 by 8 inches, or as indicated, and nominal depths as indicated on drawings for specific locations.
2. Finishes: Precision
3. Colors: As indicated. Harvest and Sandstone by Angelus.
4. Special Shapes: Provide nonstandard blocks configured for lintels, headers, control joint edges, and other detailed conditions.
5. Load-Bearing Units: ASTM C90, medium weight.
   a. Hollow block, as indicated.
   b. Exposed Faces: Manufacturer's standard color and texture where indicated.
   c. Pattern: As indicated on Drawings.
6. Unit Compressive Strength: Where indicated, provide units with minimum average net area compressive strength of 2,000 psi (Type M or S) and not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.
7. Solid Cap Unit: Nominal unit size, texture and color to match adjacent wall, unless specified otherwise.

2.2 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 05 11.

2.3 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: Type specified in Section 03 20 00; size as indicated on drawings; galvanized finish.

2.4 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

1. Manufacturers:
   a. Blok-Lok Limited: www.blok-lok.com/#sle.
   b. Dur-O-Wal: www.dur-o-wal.com.
   c. Hohmann & Barnard, Inc: www.h-b.com/#sle.
   d. WIRE-BOND: www.wirebond.com/#sle.

e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self expanding; in maximum lengths available.

1. Manufacturers:

a. Hohmann & Barnard, Inc: www.h-b.com/#sle.

b. WIRE-BOND: www.wirebond.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

1. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2-cup dry measure) and laundry detergent (1/2-cup dry measure) dissolved in one gallon of water.

2. Basis of Design Product: Enviro Klean as manufactured by ProSoCo, Inc., www.prosoco.com, or equal.

D. Proprietary Acidic Cleaners: Standard-strength cleaners designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below.

1. Do not discolor or damage masonry surfaces.

2. Cleaners shall be expressly approved for intended use by manufacturer of masonry units being cleaned.

3. Comply with applicable occupational safety and hazardous and toxic materials regulations in handling and disposing of solutions.

4. General Purpose Cleaner: For removal and control of efflorescence, removal of excess mortar, grout and common construction soiling from new masonry not subject to metallic oxidation stains.
    a. Basis of Design Product: Sure Klean No. 600 as manufactured by ProSoCo, Inc., www.prosoco.com, or equal.
5. Cleaner for Asphalt and Tar: For removing asphalt, tar, grease, hydraulic oil, motor oil and similar materials from porous masonry.
    a. Basis of Design Product: Sure Klean Asphalt & Tar Remover as manufactured by ProSoCo, Inc., www.prosoco.com, or equal.
6. Cleaner for Lime Putty Stains: For removing excess mortar, heavy lime deposits and normal construction stains from new masonry surfaces where high-strength lime putty mortar mixes have been used.
    a. Basis of Design Product: Sure Klean 101 Lime Solvent as manufactured by ProSoCo, Inc., www.prosoco.com, or equal.

E. Water Repellent: Water-based silane or siloxane masonry water repellent.
1. See Section 07 19 00 - Water Repellents.
2. Use a non-sacrificial product list in Section 09 96 23 - Graffiti-Resistant Coatings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.
B. Verify that related items provided under other sections are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
C. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.
D. Cut or trim interior of face shells or cross webs of masonry units, where necessary, to provide a minimum clearance of 1/2 inch or one bar diameter, whichever is greater, to reinforcing bars.
E. Protection of Unit Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each workday. Cover partially completed unit masonry when construction is not in progress.
1. Extend cover a minimum of 24-inches down both sides and hold cover securely in place.
F. Stain Prevention: Prevent grout, mortar, and soil from staining the face of unit masonry to be left exposed or painted. Remove immediately any grout, mortar,

and soil that come in contact with such masonry.

G. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half bond; do not tooth. Clean exposed surfaces of set masonry, and remove loose masonry units and mortar prior to laying fresh masonry.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

1. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
2. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

C. Lay hollow masonry units with face shell bedding on head and bed joints.

D. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

E. Remove excess mortar and mortar smears as work progresses.

F. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

G. Interlock intersections and external corners, except for units laid in stack bond.

H. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

I. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

1. Use full-size units without cutting where possible.

J. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

K. Isolate masonry partitions from vertical structural framing members with a

control joint as indicated.

L. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.6 CONTROL AND EXPANSION JOINTS

A. Control Joints: As indicated on Drawings.

B. Control Joints: Locate control joints maximum 24 feet on center or as indicated. If not shown, provide submittal to Architect with proposed locations for approval.

C. Expansion Joints: As indicated on Drawings.

D. Do not continue horizontal joint reinforcement through control or expansion joints.

E. Install performed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

F. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

G. Comply with Section 07 92 00 for sealant performance.

H. Form expansion joint as detailed on drawings.

3.7 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, glazed frames, fabricated metal frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.8 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Verify tolerances prior to placing next course. If the unit placed does not meet the tolerances listed below, it shall be removed and reinstalled to meet specified tolerances at no additional cost to District.

C. Maximum Variation from Alignment of Columns: 1/4 inch.

D. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

E. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

F. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

G. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

H. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

I. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.9 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Inspection and Core Tests shall be per CBC 1705A.4 and 2105A.4.

3.11 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION (CHAPTER 17A AND 21A)

A. Masonry Structures Subject to Special Inspection:

1. Masonry construction when required by the quality assurance program of TMS 402/602.
2. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".

B. Verify each item below complies with approved Contract Documents and the applicable articles of TMS 402/602.

1. Materials:

Masonry Units	CBC 2103A.1
Mortar, Portland Cement	CBC 2103A.2
Mortar and Grout Aggregates	CBC 2103A.3.1
Reinforcing Bars	CBC 2103A.4

2. Masonry Quality:

Portland Cement Tests	CBC 1903A, 1910A.1
Mortar and Grout Tests	CBC 2105A.3
Masonry Prism Tests	CBC 2105A.2
Masonry Core Tests	CBC 2105A.4
Masonry Unit Tests	CBC 2105A.2, 2105A.3, 1705A.4
Unit Strength Method Testing	CBC 2105A.2
Reinforcing Bar Tests	CBC 1910A.2
Reinforced Masonry	CBC 1705A.4; TMS 602 Tables 3 & 4, level 3
Reinforcing Bar Welding Inspection	CBC 1705A.3.1; Table 1705A.3, Item 2; 1903A.8
Post Installed Anchors in Masonry	CBC 1617A.1.19; 1705A.4, Table 1705A.3, Items 4a & 4b; 1910A.5

a. Comply with CBC 2105A.2 Compressive Strength.

b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; continuous.

3.12 REPAIRING AND POINTING

A. Repairing: Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

3.13 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

E. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
4. Clean concrete unit masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.

3.14 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members.
B. Structural steel support members.
C. Base plates, shear stud connectors.
D. Grouting under base plates.

1.2 RELATED REQUIREMENTS

A. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.
B. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.3 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual.
B. AISC 207 - Standard for Certification Programs.
C. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.
D. AISC 341 - Seismic Provisions for Structural Steel Buildings.
E. AISC 360 - Specification for Structural Steel Buildings.
F. ASTM A29/A29M - Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.
G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
K. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
L. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
M. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
N. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
O. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

P. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

Q. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.

R. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

S. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

T. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.

U. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

V. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

W. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

X. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

Y. AWS D1.1/D1.1M - Structural Welding Code - Steel.

Z. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

AA. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.

BB. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

CC. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

DD. SSPC-SP 2 - Hand Tool Cleaning.

EE. SSPC-SP 3 - Power Tool Cleaning.

FF. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Connections.
3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

E. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

F. Materials Test Reports: Submit independent test results or engineered performance analysis of structural thermal-break pad performance in bearing or slip-critical connections where shear and moment loads are applied.

G. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172, AISC 201, or City of Los Angeles Certified Fabricator.

1.5 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Maintain one copy of each document on site.

C. Fabricator: Company specializing in performing the work of this section with minimum five years of documented experience.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172, AISC 201, or City of Los Angeles Certified Fabricator.

F. Erector: Company specializing in performing the work of this section with minimum five years of documented experience.

G. Inspection: The District will employ a special inspector during all welding, and high-strength bolt installations and tightening operations, in accordance with California Building Code (CBC) requirements and other requirements of authorities having jurisdiction

1. Testing Agency Qualifications: An independent agency qualified according to ASTM E329 and Section 01 45 33 for testing indicated.

a. Special Inspector: AWS-CWI qualified inspector approved by DSA for all welding.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Comply with applicable provisions of the following building codes, including special inspection provisions:

1. California Building Code (CBC), Chapters 17A and 22A.

B. Comply with applicable provisions of the following specifications and documents as modified by the building codes:

1. AISC 341.

2. AISC 358.
3. AISC 360 including high-seismic applications.
4. AWS D1.1/D1.1M, "Structural Welding Code-Steel".
5. AWS D1.8/D1.8M, "Structural Welding Code-Seismic Supplement".
6. RCSC (HSBOLT).

2.2 MATERIALS

A. Steel Angles, Plates, and Channels: ASTM A36/A36M.
   1. Unless indicated as Grade 50 on Drawings.
B. Steel W Shapes and Tees: ASTM A992/A992M.
C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.
D. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.
E. Pipe: ASTM A53/A53M, Grade B, Finish black.
F. Shear Stud Connectors: ASTM A29/A29M.
G. Structural Bolts and Nuts: As indicated on Structural Drawings.
H. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.
I. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.
J. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers.
K. Headed Anchor Rods: ASTM F1554 Grade 36, plain.
L. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.
M. Welding Materials: AWS D1.1/D1.1M and AWS D1.8/D1.8M; type required for materials being welded.
   1. Provide E70XX-low hydrogen electrodes for shielded metal arc welding.
   2. Provide E71TXX wire type for flux-cored arc welding.
   3. The filler metal used for the welding of members of the lateral load resisting system, shall have a notch toughness not less than 20 ft.-lbs. at 20F. as measured by a standard Charpy V-notch test, ASTM E23, in accordance with the applicable filler metal specification referenced in AWS D1.1/D1.1M.
N. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Provide minimum compressive strength as indicated on Drawings.
   2. Height Change, Plastic State; when tested according to ASTM C827/C827M:
      a. Maximum: Plus 4 percent.
      b. Minimum: Plus 1 percent.
O. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
   1. SSPC-Paint 15, standard color.

2. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

P. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Develop required camber for members.

2.4 FINISH

A. General: Materials and fabrication procedures shall be subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency, as specified in Section 01 40 00 - Quality Requirements and Section 01 45 33 - Code-Required Special Inspections and Procedures.

1. Such inspections and tests do not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

2. Promptly remove and replace materials or fabricated components that do not comply.

B. Prepare structural component surfaces in accordance with SSPC-SP 3.

C. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, or high strength bolted.

D. Galvanize all exterior structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

2.5 SOURCE QUALITY CONTROL

A. Provide shop testing and analysis of structural steel.

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 100 percent of bolts at each connection.

C. Welded Connections: Visually inspect contintuously or periodically per the DSA Form 103 all shop-welded connections and test using the following where required and indicated on Drawings:

1. Ultrasonic testing performed in accordance with ASTM E164.

D. See also part 3 article "Field Quality Control".

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.3 TOLERANCES

A. Level and plumb individual members of structure within specified AISC tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

C. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

1. Special Inspector: AWS-CWI qualified inspector to inspect all welds.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts."

C. Welded Connections: Visually inspect contintuously or periodically per the DSA Form 103 all field-welded connections and test the following:

1. Ultrasonic testing performed in accordance with ASTM E164. Ultrasonic testing is required only for complete-joint-penetration groove welds in material 5/16" or thicker.

D. Report: AWS-CWI Welding inspector will submit a signed report to the Architect, Structural Engineer, Project Inspector, and Authority Having Jurisdiction (Division of the State Architect) verifying that welding was performed in compliance with specified and Code-mandated requirements and that adequate methods were used to determine the quality of the welding.

E. Re-Inspection: After correction of deficiencies in structural steel work which inspections and test reports indicate, additional inspections and tests will be performed to confirm that structural steel complies with specified requirements. Costs of re-inspections shall be paid in accordance with Conditions of the Contract.

3.5 CLEANING AND TOUCH-UP

A. Cleaning: Perform initial cleaning immediately after completion of installation. Prepare surfaces for finish painting.

B. Galvanizing Touch-Up: Touch up galvanizing immediately after installation, including field welding.

1. Prepare surface and apply cold galvanizing compound in compliance with ASTM A780/A780M and the manufacturer's instructions and recommendations.

C. Primer Paint Touch-Up: Touch up shop paint immediately after erection. Use products compliant with Section(s) 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting.

1. Clean exposed areas of rust, field welds, bolted joints, and areas where primer is damaged by SSPC-SP 2 hand tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Paint with applicable SSPC-Paint 15 (interior) or SSPC-Paint 20 (exterior) compliant material used for shop painting, minimum 3 mils dry film thickness.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof deck.

B. Supplementary framing for openings up to and including 18 inches.

C. Bearing plates and angles.

D. Acoustical insulation in roof deck flutes.

1.2 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Support framing for openings larger than 18 inches.

B. Section 05 50 00 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.3 REFERENCE STANDARDS

A. AISC 207 - Standard for Certification Programs.

B. ASTM A29/A29M - Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

D. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

G. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel.

J. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.

K. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

L. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems.

M. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements.

N. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks.

O. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

P. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

Q. UL (FRD) - Fire Resistance Directory.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

1. Provide the following data as verified by IAPMO or ICC Evaluation Service Reports:

a. Non-composite flexural effective section moduli and moments of inertia.

C. Structural design of the system using the products shown on the Drawings has already been used as a basis of approval by Division of the State Architect and other agencies.

1. If a substitution is proposed, then the Contractor is responsible for the re-approval of the documents in a timely manner within the original project schedule, along with all professional and agency fees related to this substitution.

2. See Section 01 60 00 - Product Requirements.

D. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

1. Field Measurements: Before starting shop and erection drawings, verify measurements, lines, grades, elevations, locations and details of field conditions and be responsible for correctness, conformance, accuracy and execution of construction to conform to actual conditions.

2. Detail the construction in conformance with the AISC Detailing for Steel Construction, 2nd Edition, except where otherwise indicated.

3. Field Connections and Placement Diagrams: Show field connection and placement diagrams on the erection drawings with complete details, layouts and dimensions.

4. Changes: Minor, non-structural changes from the design drawings may be shown on the shop and erection drawings provided they are clearly indicated as such. Structural changes must have prior approval from the Architect and Division of the State Architect (DSA) Structural Safety Section.

E. Certificates: Certify that products furnished meet or exceed specified requirements.

1. Insurance Certification: Assist the District in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

2. The equivalency of all proposed decking is subject to acceptance by the Architect.

F. Submit manufacturer's installation instructions.

G. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172, AISC 207, or City of Los Angeles Certified Fabricator.

1.5 QUALITY ASSURANCE

A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172, AISC 207, or City of Los Angeles Certified Fabricator.

C. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

D. Testing Agency Qualifications: An independent agency qualified according to ASTM E329 and Section 01 45 33 for testing indicated.

1. Special Inspector: AWS-CWI qualified inspector approved by DSA for all welding.

1.6 REGULATORY REQUIREMENTS

A. Regulatory Requirements: Furnish and install metal deck in accordance with the manufacturer's current ICC Evaluation Service Report and UL listing requirements to obtain diaphragm values and fire ratings indicated.

B. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire rated construction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Deck:

1. Basis of Design Product: Indicated on Drawings as manufactured by Verco Manufacturing Company, or ASC PROFILES, LLC, or approved equal.
2. ASC Steel Deck: www.ascsteeldeck.com.
    a. Structural Roof Evaluation Report: IAPMO ER-0161.
3. Epic Metals Corporation: www.epicmetals.com.
    a. Evaluation Report: IAPMO ER-0226.
4. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
    a. Evaluation Report: IAPMO ER-0423.
5. Verco Decking, Inc (a Nucor Company): www.vercodeck.com.
    a. Evaluation Report: IAPMO ER-2018.
6. Substitutions: See Section 01 60 00 - Product Requirements.
    a. Substitution may or may not be accepted after Architect and District review with complete evaluation for content and schedule impact.

b. Substitutions shall include all costs for redesign with consequential changes by other trades along with the Architect and related approvals by governing agencies. Revisions to shop drawings illustrating changes is not considered adequate for DSA review and approval.

c. Substitutions may be acceptable, based on Architect's review and approval, for submittal to DSA. If substituted manufacturer cannot reproduce DSA design and approval in a timely manner, then they shall be subject to a time and material back charge for any delays in the project. Architect approval is required prior to DSA submittal and DSA approval is required prior to installation.

2.2 STEEL DECK

A. All Deck Types: As indicated on Drawings.

B. Roof Deck: As indicated on Drawings.

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 50/340, Class 1, 2, or 4, with G90/Z275 galvanized coating.
2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
3. Structural Properties:
   a. Span Design: Multiple.
4. Minimum Base Metal Thickness: As indicated on Drawings.
5. Nominal Height: 1-1/2 inch.
6. Profile: Fluted; SDI HSB.
7. Formed Sheet Width: Per manufacturer's ICC or IAPMO approved product.
8. Side Joints: Lock seam.
9. End Joints: Welded to structure.

2.3 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.

B. Welding Materials: AWS D1.1/D1.1M and AWS D1.3/D1.3M.

1. Welding Rod: AWS A5.1-91, E70XX, Low Hydrogen.

C. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

1. Design Requirements: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
2. Material: Steel; ASTM A510/A510M.
   a. Hardness: Rockwell C 54.5, minimum.
   b. Tensile Strength: 285 kips per square inch, minimum.
   c. Shear Strength: 175 kips per square inch, minimum.
   d. Washers:
      1) Exposed Roof Deck Applications: 0.591 inch diameter, minimum.

e. Corrosion Resistance:

1) Exposed Roof Deck Applications: Provide manufacturer's standard stainless steel sealing caps with bonded neoprene washer over each fastener.

3. Products:

a. Simpson Strong-Tie: www.strongtie.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.

1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.

2. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.

3. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.

4. Hex head, stainless steel, self-drilling screws, #12 or larger, with molded washer to create water tight and permanent seal.

E. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

1. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

1. Acoustic Sound Barrier Closures: Manufacturer's standard mineral fiber closures.

I. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck.

J. Finish Paint: Manufacturer's baked-on, rust-inhibitive prime and finish paint, for application to metal surfaces which have been chemically cleaned and phosphate treated. Finish color as scheduled.

1. Finish field coating system of exposed decking specified in Section 09 91 13 - Exterior Painting.

2.4 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, 20 gage, 0.0359 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 12 gage, 0.1046 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On steel supports provide minimum 2 inch (50 mm) bearing.

C. Fasten deck to steel support members as indicated on Drawings, at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods specified.

1. Welding: Use fusion welds through weld washers.
    a. Fasten steel panels to supporting beams by electric arc welding by certified welding operators.
2. Place and secure special deep fluted sections for integral concrete bridging.

D. Fasten side seams by use of Delta Grip tool (ASC) or Punchlok tool (Verco), welding or button punching as indicated on Drawings. Provide all welding attachments or screw attachments as indicated.

1. Clinch lock seam side laps.
2. At mechanically fastened male/female side laps fasten as indicated on Drawings but not more than 24 inches on center maximum.
3. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
4. At welded male/female side laps weld as indicated on Drawings but not more than 18 inches on center maximum.

E. Weld deck in accordance with AWS D1.3/D1.3M.

F. At deck openings from 6 inches to 18 inches in size, provide 3 x 3 x 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.

G. At deck openings greater than 18 inches in size, provide steel angle reinforcement. as as inidcated on Drawings.

H. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.

I. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

1. Support at Columns: As indicated on Drawings.
    a. Where, due to cutting of deck units at columns, bearing support is not provided for the end of a web, such web shall be welded to the column or structural steel material at the column or equivalent support shall be provided.
    b. The welding or equivalent support shall be sufficient for the support of the

deck, the "wet" weight of concrete and other construction loads.

J. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

K. Place metal cant strips in position and fusion weld.

L. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

M. Touch Up of Welds: Upon cooling, touch-up all welds not to be encased in concrete topping with manufacturer's standard priming paint.

N. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.3 AS ERECTED DRAWINGS

A. After all steel has been erected, correct or revise the shop drawings erection and placement diagrams to correspond with the changes made in the field. Refer to requirements specified in Section 01 78 00 - Closeout Submittals.

3.4 FIELD QUALITY CONTROL

A. Field testing and inspection are specified in Section 01 45 33 - Code-Required Special Inspections and Procedures.

1. Special Inspector: AWS-CWI qualified inspector to inspect all welds.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed steel stud interior wall framing.

B. Formed steel exterior soffit framing and bridging.

1.2 RELATED REQUIREMENTS

A. Section 05 31 00 - Steel Decking.

B. Section 07 21 00 - Thermal Insulation: Insulation within framing members.

C. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Head and sill flashings.

E. Section 07 92 00 - Joint Sealants.

F. Section 09 21 16 - Gypsum Board Assemblies: Cold-formed steel nonstructural framing.

G. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.3 DEFINITIONS

A. General: See AISI S240 for definitions of terms used in this section.

B. Connection: A combination of structural elements and joints used to transmit forces between two or more members.

C. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.4 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

I. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

K. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

L. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

M. ASTM E413 - Classification for Rating Sound Insulation.

N. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

O. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.

P. CBC - California Building Code.

Q. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

1. Studs and Runners:

a. Provide third party documentation that framing members' meet stated design performance, AISI S240 and CBC tolerance requirements including base metal thickness, tensile strength, total elongation, chemical requirements, and metallic coating thickness. Certification by the Steel Framing Industry Association (SFIA) program, “Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members”, meets these requirements.

C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.

D. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

1. Anchoring Clips: Provide third party documentation that vertical deflection clips and drift clips meet CBC requirements and stated design performance. Certification by the Steel Framing Industry (SFIA), “Cold-Formed Connector Program”, meets these requirements

E. Steel Framing Industry Association (SFIA) Certification:

1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of California Building Code.

2. Design calculations sufficient to demonstrate compliance with design criteria; signed and sealed by a professional structural engineer.
3. Details and calculations for factory-made connectors, signed and sealed by a professional structural engineer.
4. Evaluation Service Reports: Provide reports indicating compliance with specified requirements for cold-formed steel structural members.
5. Inspection Reports: Provide material verification Inspection Reports in accordance with requirements of AISI S240.
6. Manufacturer's Installation Instructions: Provide installation instructions for connectors.

F. Evaluation Reports: Submit evaluation reports for steel studs and tracks, firestop tracks, post-installed anchors, anchoring clips and power-actuated fasteners certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

G. Manufacturer's Installation Instructions: For lateral-force resisting systems, indicate welding procedure specifications.

H. Manufacturer's Qualification statement.

I. Steel Stud Manuacturer's Certification: Submit manufacturer'sthird party certification of product compliance with codes and standards in conformance with SFIA Code Compliance Certification Program.

J. Installer's Qualification Statement.

K. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before the start of scheduled welding work.

L. SSMA Manufacturer Qualification: Submit documentation of manufacturer association membership.

M. SSFSA Manufacturer Qualification: Submit documentation of manufacturer association membership.

1.7 QUALITY ASSURANCE

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. SFIA Code Compliance Certification Program: www.CFsteel.org/#sle: Use metal studs and connectors certified for compliance with California Building Code.

C. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

1. Acceptable: Studs and track framing members certified in accordance with the “Code Compliance Certification Program” implemented by the Steel Framing Industry Association (SFIA). Deflection clips and drift clips certified in accordance with the “Cold-Formed Connector Program”, implemented by the SFIA.

D. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

Or,

E. Manufacturer Qualifications: Member of Supreme Steel Framing System Association (SSFSA): www.ssfsa.com/#sle.

F. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

G. Installer Qualifications: Company specializing in performing the work of this section with minimum three five years documented experience.

1. Acceptable: Manufacturer approval of installer, documentation of 5 years experience on similar work, and documentation of installer's recognition in the SFIA, "Contractor Certification Program".

H. Testing Agency Qualifications: An independent agency qualified according to ASTM E329 and Section 01 45 33 for testing indicated.

1. Special Inspector: AWS-CWI qualified inspector approved by DSA for all welding.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Structural Framing:

1. CEMCO: www.cemcosteel.com/#sle.
   a. ICC ESR-3016.
   b. ICC ESR-2012.
   c. Intertek CCRR-0224.
2. ClarkDietrich Building Systems: www.clarkdietrich.com.
   a. Intertek CCRR-0206.
   b. Intertek CCRR-0224.
3. FrameTek : www.usaframetek.com.
   a. ICC ESR-4205.
4. MarinoWARE: www.marinoware.com/#sle.
   a. ICC ESR-4062.
5. Or Equal Substitutions: See Section 01 60 00 - Product Requirements.

B. Connectors:

1. Same manufacturer as metal framing.
2. ClarkDietrich Building Systems: www.clarkdietrich.com.
3. MarinoWARE: www.marinoware.com/#sle.
4. Simpson Strong-Tie: www.strongtie.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with applicable building code criteria for loads, including seismic loads.

1. Design Criteria: In accordance with applicable codes.

2. Live load deflection meeting the following, unless otherwise indicated:
   a. Roofs: Maximum vertical deflection under live load of 1/240 of span.
   b. Interior Walls with other Brittle Finish: Maximum horizontal deflection under wind load of 1/240 of span.
3. Seismic Criteria: Comply with ASCE 7 and with local authorities having jurisdiction: As indicated in geotechnical report.
4. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
5. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
6. Fabrication:
   a. Shop-fabricate cold-formed framing systems and connectors to the greatest extent possible.
   b. Deliver to project site in largest practical sections.

B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assemble indicated according to ASTM E119 by an independent testing laboratory.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

D. Provide framing systems in accordance with American Iron and Steel Institute Publication AISI S240 “North American Specification for the Design of Cold-Formed Steel Framing – Structural Members”, except as otherwise shown or specified.

E. Regulatory Requirements
   1. Support framing for walls and ceilings to conform to the CBC, Title 24, Part 2, Section 2210A and Chapter 25 - Gypsum Board and Plaster. Support framing for fire resistive walls, partitions and ceilings to conform to CBC Title 24, Part 2, Chapter 7 - Fire-Resistance - Rated Construction, and as listed in the current UL"Fire Resistance Directory".
   2. Furnish and install wall framing and powder driven fasteners in accordance with the framing and fastener manufacturer's current ICC Evaluation Service Reports.

2.3 MATERIALS

A. Material and Product Requirements Criteria: As indicated on Drawings

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
   1. Structural Grade: ST33H and ST50H.

2.4 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

1. 18 Gage (43 and 22 mil) and Lighter Structural Grade: ST33H.
2. 16 Gage (54 mil) and Heavier Structural Grade: ST50H.
3. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
4. Thickness and Depth: As indicated on drawings.
5. Provide components fabricated from ASTM A1003/A1003M Designation SS (structural steel).
6. Top Track (Fire Rated): Where fire or smoke rated walls are required, provide components UL-listed for use in UL-listed fire-rated head of partition joint systems specified in this section.
    a. Provide track assembly that maintains sound rating of specified assembly.
    b. Option 1:
        1) Slotted Track with integrated intumecsent fire protection, same gage and material as wall framing or 16 gage, whichever is more restrictive. Provide dynamic joint fire protection with UL listed intumescent assembly.
            (a) Products
                (1) CEMCO: "CST"; www.cemcosteel.com, ICC-ES ESR-2012.
                (2) Brady Sliptrack Systems: "CST"; www.sliptrack.com, ICC-ES ESR-2012.
                (3) Ware Industries, Inc. (dba Marinoware): "CST"; www.marinoware.com, ICC-ES ESR-2012.
                (4) BlazeFrame: Product "BlazeFrame"; www.blazeframe.com.
    c. Option 2:
        1) At 1 and 2 hour conditions, provide field applied dynamic joint fire protection with UL listed intumescent assembly CEMCO "HOT ROD Type X", or equal assembly.
        2) Sliptrack Systems by Brady Construction Innovations, Inc., ICC Report No. ESR-1042, or approved equal, same gage and material as wall framing or 16 gage, whichever is more restrictive, slotted leg width to suit stud width.

B. Jamb Studs: AISI S240; manufactured, engineered, c-shaped with wide flanges, designed to replace conventional double-stud framing at openings.
    1. Structural Grade: ST50H and ST33H.
    2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
    3. Thickness and Depth: As indicated on drawings.

C. Headers: AISI S240; manufactured, engineered one-member or two-member assemblies, with wide flanges, designed to replace conventional box or nested header framing at openings.
    1. Structural Grade: ST50H and ST33H.
    2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
    3. Thickness and Depth: As indicated on drawings.

4. Jamb Mounting Clips: Manufacturer's standard.
5. Cripple Stud Clips: Manufacturer's standard.

D. Purlins: AISI S240; manufactured c-shaped sections.
1. Thickness and Depth: As indicated on drawings.

2.5 MISCELLANEOUS CONNECTIONS

A. Provide bolts, nuts, screws, powder driven fasteners, clips, washers and other fasteners as indicated on Drawings and as necessary for proper erection of items specified herein.

B. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

C. Bolts and nuts: ASTM A307, Grrade A.

D. Anchorage Devices: Powder actuated, Drilled expansion bolts, and Screws with sleeves.

E. Welding: Comply with AWS D1.1/D1.1M.
1. Welding Electrodes: As permitted by AWS D1.1/D1.1M and AWS D1.3/D1.3M.

2.6 ACCESSORIES

A. Incidental Steel Shapes and Framing:
1. Provide specified, indicated and required clips, plates, bent plates, angles, channels, etc., to secure the materials, equipment and items of other trades not supplied by them but necessary for the completion of Work.
2. This Section is not intended to specify each item of cold-formed structural metal framing individually.

B. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components; as indicated on Drawings.
1. Bridging: 16 gage, unless noted otherwise.
2. Standard Structural Steel Shapes and Plates: ASTM A36/A36M.
3. Miscellaneous Steel Items: ASTM A283/A283M, grade optional.
4. Flat-Rolled Carbon Steel Sheets: ASTM A1008/A1008M.
5. Cold-Rolled Carbon Steel Sheets: ASTM A1008/A1008M.
6. Backing Plates: Galvanized steel stud for attachment and support of products to be attached to framing.
a. 16 gage material covering full width of stud spacing by 6-inches wide minimum, unless indicated otherwise on Drawings.
b. As indicated on Drawings.

C. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

E. Water-Resistive Barrier: See Section 07 25 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.2 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.3 INSTALLATION OF STUDS

A. Configuration: Place and align tracks and install framing to configurations indicated on Drawings.

B. Install components in accordance with Steel Stud manufacturers' instructions and ASTM C 1007 requirements.

1. Install studs at 12-inches on center in plumbing walls and walls receiving ceramic tile finish.
2. Align studs with joists and decking flutes, as applicable.
3. Use fasteners as specified in Section 05 50 00 - Metal Fabrications, for concrete, masonry and steel construction.
4. Recesses: Provide framed openings for all recessed components. Coordinate erection of framing with installation of bucks, anchors, backing, blocking, plumbing, mechanical and electrical components to provide necessary clearances and supports for recessed products. Coordinate erection of framing with requirements for door and window frame supports and attachments.

C. Construct corners using minimum of three studs. Install double studs at wall openings over 24 inches, door and window jambs.

D. Install studs full length in one piece. Splicing of studs is not permitted.

E. Install studs, brace, and reinforce to develop full strength and achieve design requirements.

1. Stud Lateral Bracing: Provide bracing as indicated on Drawings.
2. Stud and Joist Bracing and Bridging, General: Brace studs and joists with bridging to make rigid.
    a. Cut bridging to fit between, and welded to, studs or inserted through cutouts in the web of each stud and secured to studs with welded clip angles. Provide bridging as indicated on Drawings.
    b. Provide bracing/bridging as indicated on Drawings. If not indicated, provide bridging per UL Assembly listing, Steel Framing Industry Association, ICC Report No. ESR 4205, and Steel Stud Manufacturing Association Standards, ICC Report No. ER-3064P Product Technical Guide.
    c. Where screw attached wallboard is on one side only or extends to the floor above with no screw attached material on either side, brace unbraced flanges at 4 feet on center vertically for walls and 4 feet

horizontally for joists.

F. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

G. Install intermediate studs above and below openings to align with wall stud spacing.

H. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

I. Attach backing plates to studs for attachment of fixtures anchored to walls.

1. Backing and Blocking: Install steel stud backing or sheet metal backing as indicated and as required to support all products attached to wall or ceiling after completion of finish surface, including toilet accessories, plumbing fixtures, electrical fixtures, electrical panels, toilet partitions, casework, kitchen equipment, hardware, equipment, handrails, and trim. Cut ends of runner and backing plates to each stud.

J. Coordinate erection of studs/joists with installation of service utilities to minimize discontinuity in framing. Align stud web openings.

K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

L. Touch-up field welds and damaged corrosion-protected surfaces zinc-rich paint in compliance with ASTM A780/A780M.

3.4 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with Steel Stud Manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Place joists at 12 inches on center; not more than 2 inches from abutting walls, and connect joists to supports using fastener method.

D. Set ceiling joists parallel and level, with lateral bracing and bridging.

E. Locate joist end bearing directly over load-bearing studs or provide load distribution on top of stud track.

1. Doubled Joists: Provide additional joists under parallel partitions when the partition length exceeds one-half the joist span and around all floor and roof openings, which interrupt one or more, spanning members unless otherwise indicated.

2. Provide doubled ceiling joists over all partitions running parallel with the joists.

3. Joist Bearing: Provide uniform and level joist bearing at supporting member by means of shims. At masonry and concrete conditions, provide non-shrink grout in addition to shims.

4. Joists shall have at least 1-1/2 inches of bearing and shall be reinforced over bearings to prevent web crippling.

F. End Blocking: Provide end blocking where joist ends are not otherwise restrained from rotation.

G. Provide web stiffeners at reaction points, where indicated on Drawings.

1. Provide web stiffeners at blocking at supports and points of concentrated loads.

H. Touch-up field welds with cold-galvanizing compound and damaged primed surfaces with primer.

3.5 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. An independent testing agency will perform field quality control tests, as specified in Section 01 45 33 - Code-Required Special Inspections and Procedures.

1. Special Inspector: AWS-CWI qualified inspector to inspect all welds.

C. Provide for material verification inspections in accordance with requirements of AISI S240.

D. Provide for inspections for welding, mechanical fastening, cold-formed steel light-frame construction, and lateral force-resisting systems in accordance with requirements of AISI S240.

3.6 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft, in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch in accordance with ASTM C1007.

C. Stud Spacing: 1/8 inch from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

D. Maximum Variation from True Position: 1/8 inch in 10 feet (3 mm in 3 m).

E. Maximum Variation of any Member from Plane: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 07 19 00

PENETRATING WATER REPELLENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide clear liquid penetrating water repellent coating.

1. Location: Apply water repellent to following exterior exposed surfaces.
   a. concrete unit masonry.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature.

B. Samples: Submit sample units with water repellent coating applied to half of each sample face; indicate which half has coating.

1.4 QUALITY ASSURANCE

A. Qualification of Installers: Firm with minimum five years’ successful experience in projects of similar scope.

B. Mock-Up: Prior to commencing work, including bulk purchase and delivery of material, prepare small application in unobtrusive location of typical substrate in manner acceptable to Architect.

1. Proceed only after Architect's acceptance of test application or as otherwise directed.

1.5 SITE CONDITIONS

A. Do not apply coating during inclement weather, when air temperature is below 50-degrees F, or when rain or temperatures below 40-degrees F are predicted for a period of 24 hours.

B. Do not apply coating earlier than 3 days after surfaces became wet.

C. Do not apply coating to damp, dirty, dusty, or otherwise unsuitable surfaces.

1. Allow concrete surfaces to cure minimum of 28 days unless otherwise approved in writing by coating manufacturer.

D. Protect glass, glazed products, and landscaping from contact with water repellent coating; replace materials damaged by water repellent coating.

1.6 WARRANTY

A. Extended Correction Period: Provide for correcting failure of water repellent coating to resist penetration of water.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. ProSoCo/Sure Klean SL 100.

B. Sika Corp./Sikaguard H 1000 System.

C. Chemical Products Industries Inc./CP-500W.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide silane or siloxane based clear liquid water repellent coating which does not affect appearance of coated material.

B. Performance Requirements: Provide products which are recommended by manufacturer to be fully compatible with indicated substrates and joint sealers which are in contact with water repellent coating.

C. Regulatory Requirements: Provide materials maximum volatile organic compound (VOC) emissions as required by applicable codes and regulations.

D. Water Repellent Coating: Manufacturer's standard penetrating type silane or siloxane-based sealers specified conforming to applicable limitations on volatile organic compounds.

1. Provide specific systems as recommended by manufacturer for substrates involved.

2. Finish: Water repellent coating shall not alter appearance, color, or texture of substrate under any lighting conditions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates and apply coating in strict accordance with manufacturer's recommendations.

B. Clean surfaces of dust, dirt, and foreign matter detrimental to proper installation of water repellent coating.

C. Assure coating compatibility with each type of joint sealer within or adjacent to surfaces receiving waterproof coating.

1. Mask surfaces indicated to receive joint sealers which would be adversely affected by coating.

3.2 APPLICATION

A. Apply coating in accordance with manufacturer's instructions including maximum allowable coverage.

B. Take special care to prevent damage to adjacent materials from application of coating; repair or replace materials damaged due to application of coating.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide insulation and accessories as required for complete installation.
   1. Provide nailable surface polyisocyanurate thermal board roof insulation.

B. Related Work:
   1. Section 07 52 00: Insulation integral with modified bituminous roofing.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of insulation.

   1. Submit Underwriter's Laboratory approval numbers for required fire ratings. Approvals of other laboratories contingent upon acceptance of applicable authorities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide thermal insulation with accessories.

B. Thermal Board Insulation: Preformed slag mineral or glass fiber with thermosetting resin binders forming rigid board, conforming to ASTM C612.

   1. Manufacturers:

      a. Johns Manville/Insul-Shield Insulation.
      b. Owens-Corning Fiberglas Corp./Fiberglas 700 Series Insulation.
      c. CertainTeed/CertaPro Commercial Board Insulation.
      d. Substitutions: Refer to Section 01 25 00.

   2. Flame Spread/Smoke Developed Rating: Maximum 25/450, ASTM E84.

   3. Combustibility: Pass ASTM E136.

   4. Vapor Retarder: Type I, unfaced.

   5. Vapor Retarder: Type III: Aluminum vapor retarder on one side.

   6. R-Value/Thickness: As indicated

C. Accessories: Furnish as indicated, as recommended by insulation manufacturer, and as required for insulation types, substrates, and conditions involved.

1. Fasteners and Attachment Devices: Comply with insulation manufacturer recommendations for attachment of insulation.

2. Fasteners to withstand loads specified for system.

3. Vapor Retarder Tape: Minimum 2" wide self-adhering type designed to maintain vapor retarder integrity and complying with fire resistance ratings as required by applicable codes.

4. Penetration Type Insulation Supports: Galvanized or electroplated steel penetration supports with adhesive attachment to substrate and support disc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and adjacent materials are dry and ready to receive insulation; beginning installation signifies acceptance of conditions.

B. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by Architect prior to commencement of installation.

3.2 INSTALLATION

A. General: Install insulation in accordance with manufacturer's instructions and applicable code requirements. Cut and trim insulation neatly, to fit spaces.

1. Fit insulation tight within spaces and tight to and behind mechanical and electrical services within insulation plane; leave no gaps or voids; maintain integrity of thermal barrier.

2. Backed Insulation: Use insulation free of ripped backs and edges.

3. Insulations with Vapor Retarder Facing: Install insulation with integral vapor retarder with vapor retarder toward inside of building.

4. Ceiling, wall, floor, and slab insulation shall achieve Residential Energy Services Network (RESNET) Grade 1 installation quality based on Home Energy Rating System (HERS) standards.

B. Nailable Surface Roof Insulation: Secure using fasteners recommended by insulation manufacturer for application indicated and capable of resisting wind loads specified for roofing systems applied over nailable surfaced roof board insulation.

C. Separate Vapor Retarder: Install vapor retarder in accordance with manufacturer’s recommendations and installation instructions for complete vapor retarder installation.

1. Tape joints and tears in vapor retarder.

2. Seal vapor retarder to penetrations.

END OF SECTION

SECTION 07 25 00

WEATHER-RESISTIVE BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide weather-resistive barrier/underlayment air and water barrier systems for siding, sloped roofing, flashing and sheet metal, and penetrations with accessories as required for complete watertight installation.

1. Wall Underlayment: Provide vapor permeable self-adhering sheet underlayment and flashing for exterior wall applications, with related concealed metal flashings and accessories as required for complete airtight and watertight installation.

2. Wall Underlay: Provide vapor permeable underlayment and flashing for exterior wall applications, with related concealed metal flashings and accessories as required for complete airtight and watertight installation.

    a. Contractor Option: Fluid applied membrane or sheet membrane.

3. Rainscreen Wall Underlay: Provide combined underlayment and rainscreen system with protection from ultra-violet exposure with accessories as required for complete airtight and watertight installation.

4. Rainscreen Cover: Provide separate material over wall underlayment system designed to increase flow of water back to exterior of wall assembly and, where necessary to protect underlayment from ultra-violet exposure through open joints.

5. Sloped Roofing Underlay: Provide self-adhering sheet membrane underlayment at sloped roofing systems, with accessories as required for complete watertight installation.

6. Flashings and Sheet Metal Underlay: Provide self-adhering sheet membrane underlayment at flashings and sheet metal, with accessories as required for complete watertight installation.

7. Penetrations: Provide flashing for penetrations through underlayment including but not limited to windows, doors, louvers, vents, piping, and conduit, with accessories as required for complete watertight installation.

    a. System: By same manufacturer as underlayment; system may be either fluid-applied or sheet membrane as recommended by underlayment manufacturer.

B. Related Sections:

1. Section 07 60 00: Exposed metal flashing.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Weather Barriers: Provide weather-resistive barrier/underlayment systems which, with other building components, comply with applicable code requirements for air barriers and water barriers.

1. Air Barriers: Air barriers shall be as defined by applicable Energy Code requirements and shall include standard exterior wall components and air seal joint sealants specified in Section 07 90 00 – Joint Sealants.

2. Water Barriers: Water barriers shall be as defined by applicable Building Code requirements and shall include vapor permeable systems with or without rainscreen barriers intended to extend amount of water drained to exterior.

3. Penetrations: Intent of sealing window openings, door openings, and other penetrations through underlayment is to ensure water cannot move from exterior surface past water barriers and into building.

B. Pre-Installation Meeting: Convene one week prior to commencing work; require attendance of parties directly affecting underlayment.

1. Review procedures and coordination required with related work.

C. Coordination: Coordinate air and water barrier systems with adjacent materials and assemblies to ensure material compatibility, sequencing, and air and watertight installation is achieved especially related to terminations, transitions, and penetrations.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer’s literature for each type of underlayment.

B. Samples: Furnish samples of each material.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Refer to Division 01 Requirements and *CAL*Green Environmental Compliance, and *CAL*Green.

1. Green Building Experience: Subcontractors and suppliers shall have at least two years’ successful experience in and with *CAL*Green requirements.

2. Designated Green Individual: Subcontractors and suppliers shall have one person designated responsible for green requirements.

1.5 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from water penetration. Repair system and pay for or replace damaged materials and surfaces.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide weather-resistive barrier/underlayment air and water barrier systems for siding, sloped roofing, flashing and sheet metal, and penetrations with accessories.

B. Regulatory Requirements: Provide materials conforming to applicable air quality management district limitations on volatile organic compound (VOC) emissions.

C. Regulatory Requirements: Provide materials with minimum volatile organic compound (VOC) emissions available.

D. Wall Underlay: Unperforated asphalt saturated organic felt, conforming to ASTM D226, Type I, and ASTM D4869 commonly referred to as No. 15.

E. Wall Underlay: Provide two layers Grade D water-vapor permeable kraft building paper conforming to ASTM E2556, Type II, and Fed Spec UU-B-790a, Type I, Style 2, Grade D with 60-minute water resistance rather than 10 minutes.

1. Manufacturers:

a. Henry Company (Fortifiber).
b. Davis Wire.
c. Hal Industries.
d. Substitutions: Refer to Section 01 25 00.

F. Wall Underlay: Provide vapor permeable air and water barrier underlayment system for complete watertight installation as recommended by manufacturer for substrates and applications indicated.

1. Fluid Applied Systems Manufacturers:

a. GCP Div. CertainTeed/Perm-A-Barrier VPO Fluid Applied.
b. Henry Company/Air-Bloc VP.
c. Carlisle Corp./Fire Resist Barritech VP.
d. Substitutions: Refer to Section 01 25 00.

2. Self-Adhering Sheet Underlayment Manufacturers:

a. GCP Div. CertainTeed/Perm-A-Barrier VPS Self-Adhering Sheet.
b. Henry Company/Blueskin VP160 Self-Adhered Air and Weather Barrier.
c. Carlisle Corp./CCW 705 VP.
d. Substitutions: Refer to Section 01 25 00.

G. Wall Underlay: Provide vapor permeable fluid applied air and water barrier underlayment system for complete watertight installation as recommended by manufacturer for substrates and applications indicated.

1. Manufacturers:

a. GCP Div. CertainTeed/Perm-A-Barrier VPO Fluid Applied.
b. Henry Company/Air-Bloc VP.
c. Carlisle Corp./Fire Resist Barritech VP.
d. Substitutions: Refer to Section 01 25 00.

H. Wall Underlay: Provide vapor permeable water barrier type self-adhering sheet underlayment system for complete watertight installation as recommended by manufacturer for substrates and applications indicated.

1. Manufacturers:

a. GCP Div. CertainTeed/Perm-A-Barrier VPS Self-Adhering Sheet.
b. Henry Company/Blueskin VP160 Self-Adhered Air and Weather Barrier.
c. Carlisle Corp./CCW 705 VP.
d. Substitutions: Refer to Section 01 25 00.

I. Rainscreen Type Wall Underlay, with UV Protection for Open Joint Exterior Cladding: Provide complete vapor permeable self-adhering water barrier, rainscreen, and UV protection system.

1. Manufacturers:

a. VaproShield USA/RevealShield SA System.
b. DuPont/Tyvek UV Façade System.
c. Substitutions: Refer to Section 01 25 00.

J. Rainscreen Drainage System (Separate from Underlayment): Provide system that allows moisture entering wall from exterior and condensation within wall to travel downward and exit wall area; nominal 1/8” to 1/4” thick.

1. Manufacturers:

a. Keene Building Products/Driwall Rainscreen 10mm.
b. Benjamin Obdyke/Slicker Rainscreen.
c. Substitutions: Refer to Section 01 25 00.

2. Bug Screen Insect Protection: Where not integral within rainscreen drainage system include material designed to prevent insect intrusion into wall through rainscreen drainage.

a. Manufacturers:

1) James Hardie/Bug Screen.
2) Substitutions: Refer to Section 01 25 00.

K. Sloped Roofing Underlay: Self-adhering rubberized sheet membrane with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.

1. Manufacturers:

a. GCP Div. CertainTeed.
b. Henry Company.
c. Carlisle Corp.
d. Substitutions: Refer to Section 01 25 00.

2. Provide specific membrane types as recommended by system manufacturers for each type of application.

L. High Temperature Metal Roofing Underlay: Self-adhering sheet membrane with primers and seam sealers as required for complete watertight installation; suitable for substrate and for applications indicated.

1. Manufacturers:

a. GCP Div. CertainTeed/Ultra.
b. Henry Company/Blueskin PE200HT.
c. Carlisle Corp./CCW WIP 300HT High Temp Roof Shield.
d. Substitutions: Refer to Section 01 25 00.

M. Sheet Metal and Flashing Underlay: Self-adhering rubberized sheet membrane with primers and seam sealers as required for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated.

1. Manufacturers:

a. GCP Div. CertainTeed.
b. Henry Company.
c. Carlisle Corp.
d. Substitutions: Refer to Section 01 25 00.

2. Provide specific membrane types as recommended by system manufacturers for each type of application.

N. Metal Roofing and Sheet Metal and Flashing Underlay: High-temperature self-adhering sheet membrane with primers and seam sealers as required for complete watertight installation; suitable for substrates and for applications indicated.

1. Manufacturers:

a. GCP Div. CertainTeed/Ultra.
b. Henry Company/Blueskin PE200HT.
c. Carlisle Corp./CCW WIP 300HT High Temp Roof Shield.
d. Substitutions: Refer to Section 01 25 00.

O. Penetrations: Provide flashing at penetrations with accessories for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated. System to be compatible with adjacent underlayment materials.

1. Manufacturers: Provide penetration flashing by underlayment manufacturer.

2. Provide specific membrane types as recommended by system manufacturers for each type of application.

P. Concealed Metal Flashings Integral with Underlay: Minimum 26 gage thick steel with minimum 0.90 oz/sf galvanized coating; ASTM A653.

1. Fasteners: Standard round wire type of hot dipped galvanized steel; minimum 19/64" head diameter and 0.104" shank diameter; minimum 7/8" long.

Q. Bituminous Paint: Acid and alkali resistant type; black color.

R. Accessories: Provide as indicated, as recommended by underlayment manufacturers for specific applications, and as required for complete weather-resistive barriers.

1. Concealed Sealant at Metal Flashing: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.

2.2 FLASHING FABRICATION

A. Fabricate metal flashings as recommended by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Sheet Metal Manual".

B. Form flashings to drain water to exterior at roofing and siding construction for penetrations, sill, and header flashings.

C. Form sections square, true and accurate to size, in maximum possible lengths and free from distortion and other defects detrimental to appearance or performance.

D. Hem exposed edges of metal flashings minimum 1/4" on underside.

E. Apply bituminous paint on concealed surfaces of metal flashings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with underlayment manufacturer recommendations for examination and preparation of substrates to receive underlayment.

B. Install underlayment over surfaces that are dry, free of ridges, warps and voids that could damage underlayment.

C. Coordinate installation with installation of components and items projecting through underlayment.

3.2 FLASHINGS INSTALLATION

A. Install flashings as recommended by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Sheet Metal Manual".

B. Weatherlap joints minimum 2", seal with plastic cement, and secure in place.

C. Fastenings: Concealed in completed installation.

3.3 UNDERLAYMENT INSTALLATION

A. Install weather-resistive barrier in accordance with installation instructions and recommendations of each manufacturer and of manufacturers of products to cover weather-resistive barrier; comply with applicable code requirements.

1. Wall Underlay: Provide one-layer No. 15 building paper underlayment.

2. Wall Underlay: Provide two-layers Grade D building paper underlayment.

3. Wall Underlay: Contractor option fluid-applied underlayment or sheet membrane underlayment as recommended by manufacture for applications indicated.

4. Wall Underlay: Provide fluid applied underlayment.

5. Wall Underlay: Provide one-layer sheet membrane underlayment.

6. Rainscreen System: Install in accordance with manufacturer recommendations and installation instructions.

7. Sloped Roofing: Provide one-layer sheet membrane underlayment.

8. Flashing and Sheet Metal: Provide one-layer sheet membrane underlayment.

9. Penetrations: Apply penetration flashing extending minimum 18" from penetrations, including windows and doors; start at bottom of penetration and weatherlap.

    a. Apply over metal flashing to direct water to exterior.

10. Weatherlap joints as recommended by system manufacturer.

    a. Weatherlap joints not less than 2” at building paper.

11. Secure underlayment in place, stagger joints between sheet membrane layers; lap ends minimum 6"; stagger end joints.

B. Fluid Applied Membrane: Prime substrates when recommended by system manufacturer and apply using methods to ensure dry film thickness complies with manufacturer recommendations for each application.

C. Sheet Membranes: Weatherlap items projecting through sheet membrane underlayment and seal with sealer recommended by sheet membrane underlayment manufacturer.

D. Building Paper Underlay: Prime substrates and roll sheet membrane underlayment smooth, firmly, and completely to surfaces indicated, with no fish-mouths or bunches of material.

1. Apply plastic cement to substrate prior to application of underlayment starter strips to prevent capillary movement of water back up beneath underlayment.

2. Weatherlap items projecting through building paper underlayment and seal with plastic cement.

END OF SECTION

SECTION 07 26 00

BELOW-GRADE VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide vapor retarder system for below grade and slab-on-grade concrete, including sealing joints and protrusions through vapor retarder.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's literature.

B. Sustainability Certification Points: Submit information and certifications necessary to demonstrate *CAL*Green compliance.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Refer to Division 01 for specific *CAL*Green Environmental Compliance.

1. Designated Green Individual: Subcontractors and suppliers shall have one person designated responsible for Cal Green code compliance requirements.

1.4 SITE CONDITIONS

A. Do not apply vapor retarder during inclement weather or when air temperature is below 40 degrees F.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Fortifiber Corp./Ultra 15.

B. Raven Industries, Inc./Vapor Block # VB 15 (15 mil Blue).

C. Stego Industries, Inc./Stego Wrap (15 mil).

D. W.R. Meadows/Perminator (15 mils).

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description Includes: Provide vapor retarder system for below grade and slab-on-grade concrete, including sealing joints and protrusions through vapor retarder.

B. Vapor Retarder: ASTM E1745, Class A vapor retarder consisting of 15 mil polyolefin film.

1. Permeance: Maximum 0.025 perms, ASTM F1249 and E154 tests.

2. Resistance to Puncture: Minimum 2200 grams, ASTM D1709, Method B.

3. Tear Resistance: Minimum 8.74 lbs., ASTM D1004.

4. Tensile Strength: Minimum 35 lbs/in., ASTM E154, Section 9, Method D-882, in both directions.

C. Joint Sealer: Pressure sensitive tape as recommended by vapor retarder manufacturer and providing comparable permeance to vapor retarder.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure sleeves, curbs and projections that penetrate vapor retarder are properly and rigidly installed.

B. Ensure substrate is free of projections and irregularities that may be detrimental to proper installation of vapor retarder.

3.2 INSTALLATION

A. Apply vapor retarder in accordance with manufacturer's recommendations and installation instructions and in accordance with ASTM E1643; comply with most restrictive where conflicts occur.

1. Seal perimeters and items projecting through vapor retarder with pressure sensitive tape.

B. Seams: Minimum 12" overlap, sealed with pressure sensitive tape for vapor tight seal.

C. Lay vapor retarder membrane smooth with no fish-mouths or bunches of material.

D. Inspect and repair vapor retarder prior to application of concrete slab; tape tears and repair damage.

END OF SECTION

SECTION 07 41 15

MANUFACTURED STANDING SEAM ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide factory finished manufactured metal standing seam type roofing including integral metal flashings and sealants, and accessories as required for complete weather-tight installation.

B. Related Work:

1. Section 07 21 00: Thermal insulation.
2. Section 07 25 00: Weather barrier/underlayment.
3. Section 07 60 00: Flashing and sheet metal not integral with roofing.

1.2 REFERENCES

A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Convene pre-construction conference one week prior to metal roofing work to coordinate roofing with other trades; require attendance of parties directly affecting metal roofing work.

1. Review installation and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for prefabricated components, and recommendations for cleaning and protection.

B. Shop Drawings: Indicate dimensioning, panel layout, general construction details including closures, flashings, locations of and types of sealants, and anchorage.

C. Samples: Furnish finished preformed metal roofing and each type of exposed metal flashing.

1.5 QUALITY ASSURANCE

A. Qualification of Installer: Company with minimum five years’ successful experience in work of comparable scope.

B. Mock-Up: Provide 200 square foot mock-up of metal roofing construction at location approved by Architect; approved mock-up may be incorporated into Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide protective covering on finished flashing materials to protect them through installation.

1.7 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.

1. Period: Three years.

B. Manufacturer’s Warranty: Submit manufacturer’s warranty including special manufacturer services as required for manufacturer’s warranty.

1. Period: 20 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner’s rights under implied and expressed warranties regardless of wording of manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. AEP Span. (Basis of Design)

B. Berridge Manufacturing Co.

C. ATAS International, Inc.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description Includes: Provide factory finished manufactured metal standing seam type roofing including integral metal flashings and sealants, and accessories.

B. Regulatory Requirements: Comply with California Building Standards Code requirements for metal roofing systems.

1. Cool Roof System: Comply with California Building Standards Code requirements for “Cool Roof” system including three-year aged solar reflectance value requirements.

a. Label: System to have Cool Roof Rating Council (CRRC) label.

C. Design Criteria: Design system to provide movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100-year seasonal temperature ranges.

1. Design system to accommodate tolerances of structure, provided irregularities do not exceed industry recognized standards and clearances are maintained.

2. Provide for positive drainage of water entering or occurring within preformed metal roofing system.

D. Standing Seam Metal Roofing System: Preformed metal roofing system complete with anchoring assembly and accessory components.

1. Type: Manufacturer's standard standing seam system specified with pans approximately 16" on center unless otherwise indicated.

2. Sheet Metal: Minimum 24-gage galvanized steel, minimum G90 galvanized coating, ASTM A924 and A653.

3. Finish: Manufacturer's standard fluoropolymer coil coat finish complying with AAMA 2605.

a. Color: As indicated, as selected by Architect from manufacturer's full range of colors where not otherwise indicated.

E. Sealants and Gaskets: Manufacturer's standard type suitable for use in conjunction with installation of metal roofing.

1. Non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior applications.

2. Color of exposed sealants and gaskets to match roofing.

F. Fasteners: Manufacturer's standard hot dip galvanized fasteners with not less than G90 galvanized coating.

1. Finish exposed fasteners to match roofing.

G. Underlayment: Specified in Section 07 25 00 – Weather-Resistive Barrier.

H. Accessories: Provide as indicated, as recommended by system manufacturer, and as required for complete weather tight installation.

2.3 FABRICATION

A. Internal and External Corners: Same materials, material thickness and finish as roofing, profile to suit system, brake formed, shop-cut and factory mitered to required angles.

B. Mitered internal corners shall be backed with minimum 22-gage galvanized steel sheet stock to maintain continuity of profile.

C. Expansion Joints: Provide concealed metal expansion control throughout roofing system.

D. Integral Sheet Metal, Flashings, Gutters, Closures and Other Components: Brake formed to required profiles; conform to SMACNA Manual.

1. Conform to requirements specified in Section 07 60 00 - Flashing and Sheet Metal

E. Provide for positive drainage to exterior, any water entering or occurring within metal roofing systems.

.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate is free of elements that could be harmful to system.

B. Beginning of work signifies acceptance of conditions.

C. Take special care not to damage underlayment beyond that required to secure system to structure.

3.2 INSTALLATION

A. Install manufactured metal standing seam roofing in accordance with manufacturer's recommendations, installation instructions, and approved shop drawings.

B. Install metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Comply with installation requirements specified in Section 07 60 00 - Flashing and Sheet Metal.

C. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.

D. Protect metal surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow protective coating to dry prior to installing members.

E. Permanently fasten roofing system to structural supports, properly aligned, leveled and plumb.

1. Maximum 1/16" offset from true alignment between adjacent members butting or in line.

2. Maximum 1/4" variation from plane or location indicated on Drawings.

F. Locate end laps over supports; end lap panels minimum 2"; ensure side-laps are over firm bearing.

G. Provide expansion joints at regular basis, concealed within system.

H. Use concealed fasteners except where specifically approved by Architect.

I. Install sealants and gaskets where required to prevent direct weather penetration.

J. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.

K. Remove protective coating when no longer required to protect roofing and flashing from construction.

END OF SECTION

SECTION 07 42 40

METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide factory finished corrugated metal panel systems including anchors, accessories, integral factory finished metal flashing, closures, gaskets, concealed sealants, and components for complete, weather-tight installation.

B. Related Sections:

1. Section 07 25 00: Weather-resistant barrier underlayment.
2. Section 07 42 45: Composite metal building panels.
3. Section 07 60 00: Metal flashing not integral with metal wall panels.
4. Section 07 90 00: Joint sealants not concealed after panels are in place.

1.2 REFERENCES

A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Convene pre-construction conference one week prior to metal panel work to coordinate with other trades; require attendance of parties directly affecting metal panel work.

1. Review installation and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's literature and recommendations for cleaning and protection.

B. Shop Drawings: Clearly indicate dimensioning, panel layout, general construction details including closures, flashings, locations and types of sealants, anchorages and method of anchorage.

C. Samples: Furnish finished samples of each type of corrugated metal, exposed flashing, exposed closures, and gaskets.

1. .

2. *CAL*Green: Submit additional information as necessary to verify compliance with requirements.

1.5 QUALITY ASSURANCE

1. .

B. Qualification of Installer: Company with minimum five years' successful experience in work of comparable scope.

C. Mock-Up: Provide 100 square foot mock-up of corrugated metal panel construction at location approved by Architect; approved mock-up may be incorporated into Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide protective covering on factory finished materials to protect them through installation.

1.7 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.

1. Period: Two years.

B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.

1. Period: 10 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. AEP Span, Basis of Design

B. CENTRIA.

C. PAC-CLAD Petersen, a Carlisle Co.

D. MBCI.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide factory finished corrugated metal panel systems including anchors, accessories, components, and integral sheet metal.

B. Regulatory Requirements: Comply with California Building Standards Code requirements for metal panel systems.

1. Maximum Allowable Deflection: Member length/360.

C. Design Criteria: Design system to provide movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100-year seasonal temperature ranges.

1. Design system to accommodate tolerances to structure, provided irregularities do not exceed industry recognized standards and clearances are maintained.

2. Provide for positive drainage of any water entering or occurring within system.

D. Metal Panel Systems: Provide metal panel systems with anchoring assemblies and accessory components as required for complete, weathertight installation.

1. Type: Standard 1/2" corrugated profile with approximately 2.66" pitch.

2. Metal: Minimum 24 gage galvanized steel; minimum ASTM A924 and A653 G90 galvanized coating; provide heavier gages where design configurations exceed manufacturer recommendations.

3. Finish: Exposed surfaces shall have fluoropolymer type finish based on Kynar 500 or Hylar 5000 and complying with AAMA 2605.

a. Color: As indicated, as selected by Architect from manufacturer's full range of colors where not otherwise indicated.

E. Integral Sheet Metal: Minimum 24 gage G90 galvanized steel with finish matching metal roof and wall panel system.

F. Fasteners: Manufacturer’s standard galvanized minimum G90 coating.

1. Finish exposed fasteners to match system.

G. Closures, Gaskets and Concealed Sealants: Manufacturer's standard non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior applications.

1. Color: Exposed materials color to match adjacent panel system, unless otherwise approved by Architect.

H. Accessories: Provide as indicated, as recommended by system manufacturer, and as required for complete secure installation.

2.2 FABRICATION

A. Internal and External Corners: Provide same materials, material thickness and finish as system.

1. Design profile to suit system, brake form, shop cut and factory miter to required angles.

2. Back mitered internal corners with minimum 24 gage sheet stock to maintain continuity of profile.

B. Expansion Joints: Provide concealed metal expansion control throughout system.

C. Sheet Metal Flashings, Closures and Other Components: Brake formed to required profiles.

1. Comply with requirements for fabrication specified in Section 07 60 00 - Flashing and Sheet Metal.

D. Provide for positive drainage to exterior, any water entering or occurring within corrugated metal panel systems.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate is free of elements that could be harmful to system.

B. Beginning of work signifies acceptance of conditions.

C. Take special care not to damage underlayment beyond that required to secure system to structure.

3.2 INSTALLATION

A. Install metal panel systems in accordance with manufacturer's recommendations and installation instructions and approved shop drawings.

B. Install integral metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Comply with installation requirements specified in Section 07 60 00 - Flashing and Sheet Metal.

C. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.

D. Protect metal surfaces in contact with cementitious materials and dissimilar metals with asbestos free bituminous paint.

1. Allow protective coating to dry prior to installing members.

E. Permanently fasten system to substrate, properly aligned, leveled and plumb.

1. Offset from True Alignment: Maximum 1/16" between adjacent members butting and in line.

2. Variation from Location: Maximum 3/4" from plane or location indicated on Drawings.

F. Locate end laps over supports; end lap panels minimum 2", ensure sidelaps are over firm secure bearing.

G. Provide expansion joints on a regular basis, concealed within system.

H. Install sealants and gaskets where required to prevent direct weather penetration.

I. Completed installation shall be free of rattles and noise due to thermal and air movement, and wind whistles.

J. Remove protective coating when no longer required to protect roofing and flashing from construction.

END OF SECTION

SECTION 075500
MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, equipment, and miscellaneous materials to install District purchased and furnished roofing materials over the properly prepared substrate
   1. All products listed in 2.1, D will be furnished by the District. All products not listed in 2.1, D to be furnished by the Contractor. All products listed in 2.1, D will be manufactured by The Garland Company and purchased by Oceanside USD

B. Scope of Work:

   1. Apply Pro Stop FR Primer at ½ gal per sq to any wood deck or wood curb surfacings.
   2. Mechanically fasten R10 polyiso insulation to the metal deck (Z1: 12, Z2: 18, Z3: 24).
   3. Install polyiso crickets in the drum areas to ensure positive drainflow.
   4. Adhere ½" Denseckprime coverboard in Insul Lock HR.
   5. Apply one ply of SA Base IV.
   6. Apply SBS-modified cap sheet – Stressply IV Plus UV Mineral – with torch application.
   7. Flashing Areas:
      a. Flashing areas: Apply base flashing ply – SA Base IV -- with torch application extending 6" onto the roof field. Apply cap flashing ply -- Stressply IV Plus UV Mineral -- with torch application extending 9" onto the field. All flashings to be terminated with a termination bar set in butyl tape. All flashings plies to be terminated with a termination bar set in butyl tape and fastened every 6" o.c. Caulk above the termination bar.
      b. ~~Parapet Walls: Wrap the flashing plies up and over the wall extending 2" down per manufacturer details.Install new .032 aluminuum, kynar coping cap metal. District to approve color. All metal to be fabricated with RMER SS Flat Stock.~~
      c. Edge Metal: Install new, .032 aluminum edge with kynar finish. All metal to be fabricated with RMER SS Flat Stock.
      d. Drains: Sump all drains.
   8. Surfacing: Apply Cool Sil to all waterways. Apply at 3.5 gal per sq. Embed 28-30lbs per sq of Title 24 compliant white minerals.
   9. Install new lead flashings at penetrations. Umbrella cover required for the lead flashing. No pitch pockets.
   10. Place all conduits, pipes and any other utility lines on new rubber blocks – Dura Blocks.

1.2 REFERENCES

A. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

B. ASTM D 312 - Standard Specification for Asphalt used in Roofing.

C. ASTM D 451 - Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.

D. ASTM D 1970 - Specification for Sheet Materials, Self-Adhering Polymer Modified Bituminous, Used as Steep Roofing Underlayment for Ice Dam Protection.

E. ASTM D 1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.

F. ASTM D 1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

G. ASTM D 1863 Standard Specification for Mineral Aggregate Used as a Protective Coating for Roofing.

H. ASTM D 2178 Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.

I. ASTM D 2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.

J. ASTM D 4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free.

K. ASTM D 4601 Standard Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.

L. ASTM D 5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.

M. ASTM D 6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.

N. ASTM D 6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.

O. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

P. ASTM D 6754 - Standard Specification for Ketone Ethylene Ester (KEE) Sheet Roofing.

Q. ASTM D 6757 - Standard Specification for Underlayment Felt Containing Inorganic Fibers Used in Steep-Slope Roofing.

R. ASTM E 108 - Standard Test Methods for Fire Test of Roof Coverings

S. Factory Mutual Research (FM): Roof Assembly Classifications.

T. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.

U. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.

V. Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.

W. Warnock Hersey (WH): Fire Hazard Classifications.

X. ANSI-SPRI ES-1 Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.

Y. ASCE 7, Minimum Design Loads for Buildings and Other Structures

Z. UL - Fire Resistance Directory.

AA. FM Approvals - Roof Coverings and/or RoofNav assembly database.

BB. FBC - Florida Building Code.

CC. Miami-Dade Building Code Compliance - N.O.A. (Notice of Acceptance).

DD. California Title 24 Energy Efficient Standards.

1.3 SUBMITTALS

A. Contractor shall submit all required documents such as, but not limited to Installer’s Qualifications, Shop Drawings, and warranties. Requests for substitutions are subject to review according to the General Conditions. If approved, substitution material must conform to all required Submittals.

B. Product Data:
1. Except Owner Furnished Contractor Installed (OFCI) materials, contractor shall submit manufacturer product data for all products necessary for completion of roofing system and as specified including manufacturer's technical product data, installation instructions and recommendations for each type of roofing product required. Include data substantiating that materials comply with minimum specified requirements.

C. Test Data and Certifications:
1. Submit independent test data that indicates the cap sheet complies with CRCC and title 24 requirements.

D. Installer Qualifications:
1. Submit installer qualifications; Refer to Quality Assurance article below.

E. Samples:
1. Submit samples of any non OFCI materials necessary for completion of

roofing system.

F. Warranty:
1. Submit unexecuted Manufacturer's Thirty Year High-Performance No Dollar Limit (NDL) warranty covering LABOR AND MATERIALS for ALL components of the roofing system required against leaks, edge to edge (perimeter metal) and deck up (all base sheets, flashing components and insulation. Warranty covers: Metal Coping, Counter flashing, and Edge metal where applicable, insulation, base ply, cap, coating, lead flashings, and any and all miscellaneous roof flashings. This warranty shall be provided by Garland Company. Contractor is responsible to achieve this warranty by all needed coordination with Garland Company.
2. Contractor shall provide five (5) years labor warranty to Garland Company and the District.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer (Roofer), who can be the general contractor or his / her roofing subcontractor, shall be specializing in modified bituminous roof application with minimum 10 years' experience. Installer shall provide proof of certification to install Garland Company's roofing system within the past three (3) years. Roofing Contractor to submit minimum at time of awarding the contract a letter from Garland Company stating the Installer is a certified installer in good standing and approved to install the roofing system. The issuance date of the above addressed letter shall be maximum fifteen (15) days prior to this project's bid date. This letter shall be provided to the District prior to award of the contract.

B. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified with documented ISO 9001 certification and minimum of twelve years of documented experience and must not have been in Chapter 11 bankruptcy during the last five years.

D. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience and a certified Pre-Approved Garland Contractor.

E. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress.

F. Product Certification: Provide manufacturer's certification that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.

G. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.

1.5 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section.

B. Review installation procedures and coordination required with related Work.

C. Inspect and make notes of job conditions prior to installation:
   1. Record minutes of the conference and provide copies to all parties present.
   2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
   3. Installation of roofing system shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Contractor responsible to coordinate OFCI material delivery by Garland Company and RBUSD.

B. Store all roofing materials in a dry place, on pallets or raised platforms, out of direct exposure to the elements until time of application. Store materials at least 4 inches above ground level and covered with "breathable" tarpaulins.

C. Receive OFCI material to site with seals and labels intact, in manufacturer's original containers, dry and undamaged. Any damaged material to be noted at delivery and reported immediately to the District and Garland Company.

D. Contractor responsible for materials upon delivery. Any lost or stolen material must be replenished by the General Contractor / Installer. District is absolved of any liability in regards to material delivery or material storage.

E. Store and handle roofing sheets in a dry, well-ventilated, weather-tight place to ensure no possibility of significant moisture exposure. Store rolls of felt and other sheet materials on pallets or other raised surface. Stand all roll materials on end. Cover roll goods with a canvas tarpaulin or other breathable material (not polyethylene). District reserves the right to have all material delivered and stored by the contractor on non- District property at no additional charge to the District.

F. Do not leave unused materials on the roof overnight or when roofing work is not in progress unless protected from weather and other moisture sources.

G. It is the responsibility of the Contractor to secure all material and equipment on the job site. If any material or equipment is stored on the roof, the Contractor must make sure that the integrity of the deck is not compromised at any time. Damage to the deck caused by the Contractor will be the sole responsibility of the Contractor and will be repaired or replaced at his expense.

H. Store at room temperature wherever possible, until immediately prior to installing the roll. During winter, store materials in a heated location with a 50 degree F (10 degree C) minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.

I. Avoid stockpiling of materials on roofs without first obtaining acceptance from the

Architect/Engineer.

J. Adhesive storage shall be between the range of above 50 degree F (10 degree C) and below 80 degree F (27 degree C). Area of storage shall be constructed for flammable storage.

1.7 COORDINATION

A. Coordinate Work with installing associated metal flashings as work of this section proceeds.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. Upon completion of the work, provide the Manufacturer's written and signed NDL Warranty, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installing contractor, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the labor and material necessary to return the defective area to a watertight condition.
   1. Warranty Period:
      a. 30 years from date of acceptance.
      b. Provide minimum five (5) year labor warranty to District and Garland Company at no charge.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The design is based upon the board approved, District standard roofing systems engineered and manufactured by The Garland Company:

The Garland Company
Miles Taylor
310.367.7655

B. Roofing Contractor to be responsible for all Garland materials in excess of District purchased and furnished amount. District to provide material quantities matching the specified amount below. Any additional Garland material required to complete the project is the responsibility of the roofing contractor. Roofing Contractor responsible for purchasing additional materials required, including all freight and tax charges.

C. Roofing contractor to be at delivery of District purchased roof materials. The District

has no responsibility to provide any equipment for handling and / or loading the materials to the Contractor's trucks. District reserves the right to have all material delivered and stored by the contractor on non- District property at no additional charge to the District. Upon signature of delivery, the roofing contractor assumes full responsibility for all District purchased roof materials. Any materials lost or stolen are the responsibility of the roofing contractor to replace. Roofing Contractor responsible for freight and tax on the replaced materials.

D. Maximum quantity of the OFCI materials which will be provided to the Contractor (075500) are as follows:

E.

Material	Amount	Unit Size
SA Base IV	1055	Rolls
Stresspy IV UV Plus Mineral	1399	Rolls
Pro Stop FR Primer	10	5 Gal
Flashing Bond	52	5 Gal
Tuff Stuff Caulking	199	Tube
Garla Prime VOC	5	5 Gal

2.2 TORCH APPLIED 2-PLY ASPHALT ROOFING

A. Base (Ply) Sheet:
   1. Sa Base IV

B. Modified Cap (Ply) Sheet: One ply bonded to the prepared substrate with interplay adhesive.
   1. StressPly IV Plus UV Mineral:

C. Flashing Base Ply:
   1. HPR Torch Base

D. Flashing Cap (Ply) Sheet
   1. StressPly IV Plus UV Mineral:

E. Flashing Ply Adhesive:
   1. None for torch sheets only.

2.3 ACCESSORIES:

A. Nails and Fasteners: Non-ferrous metal or galvanized steel, except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel, Fasteners shall be self-clinching type of penetrating type as recommended by the deck manufacturer. Fasten nails and fasteners flush-driven through flat metal discs not less than 1 inch (25 mm) diameter. Omit metal discs when one-piece composite

nails or fasteners with heads not less than 1 inch (25 mm) diameter are used.

B. Walkway Pads - Commercial Innovations Walkway Pads: As recommended and furnished by the membrane manufacturer set in approved adhesive to control foot traffic on roof top surface and provide a durable system compliant non-slip walkway.

C. Sealant - Green-Lock Structural Adhesive: Single component, 100% solids structural adhesive as furnished and recommended by the membrane manufacturer.
   1. Elongation, ASTM D 412: 300%
   2. Hardness, Shore A, ASTM C 920: 50
   3. Shear Strength, ASTM D 1002: 300 psi

D. Butyl Tape: 100% solids, asbestos free and compressive tape designed to seal as recommended and furnished by the membrane manufacturer.

2.4 EDGE TREATMENT AND ROOF PENETRATION FLASHINGS

A. Vents and Breathers: Heavy gauge aluminum and fully insulated vent that allows moisture and air to escape but not enter the roof system as recommended and furnished by the membrane manufacturer.

B. Pitch pans, Rain Collar 24 gauge stainless or 20oz (567gram) copper. All joints should be welded/soldered watertight. See details for design.

C. Drain Flashings should be 4lb (1.8kg) sheet lead formed and rolled.

D. Plumbing stacks should be 4lb (1.8kg) sheet lead formed and rolled.

E. Manufactured Roof Specialties: Shop fabricated copings, fascia, gravel stops, control joints, expansion joints, joint covers and related flashings and trim are specified in Section 07710.
   1. Manufactured roof specialties shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the NRCA "Roofing and Waterproofing Manual" as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Inspect and approve the deck condition, slopes and fastener backing if applicable, parapet walls, expansion joints, roof drains, stack vents, vent outlets, nailers and surfaces and elements.

C. Verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been properly completed.

D. If substrate preparation and other conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. General: Clean surfaces thoroughly prior to installation.
   1. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   2. Fill substrate surface voids that are greater than 1/4 inch wide with an acceptable fill material.
   3. Roof surface to receive roofing system shall be smooth, clean, free from loose gravel, dirt and debris, dry and structurally sound.
   4. Wherever necessary, all surfaces to receive roofing materials shall be power broom and vacuumed to remove debris and loose matter prior to starting work.
   5. Do not apply roofing during inclement weather. Do not apply roofing membrane to damp, frozen, dirty, or dusty surfaces.
   6. Fasteners and plates for fastening components mechanically to the substrate shall provide a minimum pull-out capacity of 300 lbs. (136 k) per fastener. Base or ply sheets attached with cap nails require a minimum pullout capacity of 40 lb. per nail.
   7. Prime decks where required, in accordance with requirements and recommendations of the primer and deck manufacturer.

B. Metal Deck:
   1. Fastening of the deck should comply with the anticipated live and dead loads pertaining to the building as well as applicable Code.
   2. Steel decks shall be minimum 22-gauge factory galvanized or zinc alloy coated for protection against corrosion.
   3. Suitable insulation shall be mechanically attached as recommended by the insulation manufacturer.
   4. Decks shall comply with the gauge and span requirements in the current Factory Mutual FM Approval Guide and be installed in accordance with Loss Prevention Data Sheet 1-28 or specific FM approval.
   5. When re-roofing over steel decks, surface corrosion shall be removed, and repairs to severely corroded areas made. Loose or inadequately secured decking shall be fastened, and irreparable or otherwise defective decking shall be replaced.

C. Wood Deck:
   1. Dimensional wood deck shall be minimum 1 inch (25 mm) thick, knotholes and cracks larger than 1/4 inch shall be covered with sheet metal. All boards shall be appropriately nailed and have adequate end bearing to the centers of beams/rafters. Lumber shall be kiln dried.
   2. Plywood shall be a minimum 15/32 inch (11.9 mm) thick and conform to the standards and installation requirements of the American Plywood Association (APA).
   3. If no roof insulation is specified, provide a suitable dry sheathing paper, followed by an approved base sheet nailed appropriately for the specified roof system, with 1 inch (25 mm) diameter caps and annular nails unless otherwise required by the applicable Code or Approval agency.
   4. Insulation is to be mechanically attached in accordance with the insulation manufacturer's recommendations unless otherwise required by the applicable

Code.

5. In all retrofit roof applications, it is required that deck be inspected for defects. Any defects are to be corrected per the deck manufacturer's recommendations and standards of the APA/Engineered Wood Association prior to new roof application.
6. Light metal wall ties or other structural metal exposed on top of the wood deck shall be covered with one ply of a heavy roofing sheet, such as a Type II Base Sheet, extending 2 inches to 6 inches (51 mm to 152 mm) beyond the metal in all directions. Nail in place before applying the base ply.

D. Insulation:
1. All joints between layers should be staggered when multiple layers of insulation are installed. Insulation greater than 2.5 inches shall be installed in multiple layers.
2. Insulation shall be kept dry at all times. Install only as much insulation as can be covered with completed roofing membrane before the end of the day's work or prior to onset of inclement weather.
3. Edges shall butt tightly and all cuts shall fit neatly against adjoining surfaces to provide a smooth overall surface. Gaps of greater than 1/4 inch width shall be filled with insulation.
4. Install tapered insulation around roof drains and penetrations to provide adequate slope for proper drainage.
5. Mechanically attached insulation shall be fastened in accordance with code and insurance requirements for the applicable geographic zone with the required number and type of fasteners and plates.

3.3 INSTALLATION - GENERAL

A. Install modified bitumen membranes and flashings in accordance with manufacturer's instructions and with the recommendations provided by the National Roofing Contractors Association's Roofing & Waterproofing Manual, the Asphalt Roofing Manufacturers Association, and applicable codes.

B. General: Avoid installation of modified bitumen membranes at temperatures lower than 40-45 degrees F. When work at such temperatures unavoidable use the following precautions:
1. Take extra care during cold weather installation and when ambient temperatures are affected by wind or humidity, to ensure adequate bonding is achieved between the surfaces to be joined. Use extra care at material seam welds and where adhesion of the applied product to the appropriately prepared substrate as the substrate can be affected by such temperature constraints as well.
2. Unrolling of cold materials, under low ambient conditions must be avoided to prevent the likelihood of unnecessary stress cracking. Rolls must be at least 40 degrees F at the time of application. If the membrane roll becomes stiff or difficult to install, it must be replaced with roll from a heated storage area.

C. Commence installation of the roofing system at the lowest point of the roof (or roof area), working up the slope toward the highest point. Lap sheets shingle fashion so as to constantly shed water

D. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank 1 inch cap nails, or screws and plates at a rate of 1 fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and 4 feet o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install 4 additional fasteners at the upper edge of the membrane when strapping the plies.

3.4 INSTALLATION TORCH APPLIED 2-PLY ASPHALT ROOFING

A. Base Ply: Install torch base sheet to a properly prepared substrate. Shingle in proper direction to shed water on each area of roofing.
   1. Lay out the roll in the course to be followed and unroll 6 feet (1.8 m).
   2. Using a roofing torch, heat the surface of the coiled portion until the burn-off backer melts away. At this point, the material is hot enough to lay into the substrate. Progressively unroll the sheet while heating and press down with your foot to insure a proper bond.
   3. After the major portion of the roll is bonded, re-roll the first 6 feet (1.8 m) and bond it in a similar fashion.
   4. Repeat this operation with subsequent rolls with side laps of 4 inches (101 mm) and end laps of 8 inches (203 mm).
   5. Give each lap a finishing touch by passing the torch along the joint and spreading the melted bitumen evenly with a rounded trowel to insure a smooth, tight seal.
   6. Extend underlayment 2 inches (50 mm) beyond top edges of cants at wall and projection bases.
   7. Install base flashing ply to all perimeter and projections details.

B. Modified Cap (Ply) Sheet: Over torch base sheet underlayment, lay out the roll in the course to be followed and unroll 6 feet (1.8 m). Stagger seams over the torch base sheet seams.
   1. Using a roofing torch, heat the surface of the coiled portion until the burn-off backer melts away. At this point, the material is hot enough to lay into the substrate. Progressively unroll the sheet while heating and press down with your foot to insure a proper bond.
   2. After the major portion of the roll is bonded, re-roll the first 6 feet (1.8 m) and bond it in a similar fashion.
   3. Repeat this operation with subsequent rolls with side laps of 4 inches (101 mm) and end laps of 8 inches (203 mm).
   4. Give each lap a finishing touch by passing the torch along the joint and spreading the melted bitumen evenly with a rounded trowel to insure a smooth, tight seal.

C. Fibrous Cant Strips: Provide non-combustible perlite or glass fiber cant strips at all wall/curb detail treatments where angle changes are greater than 45 degrees. Cant may be set in approved cold adhesives, hot asphalt or mechanically attached with approved plates and fasteners.

D. Wood Blocking, Nailers and Cant Strips: Provide wood blocking, nailers and cant

strips as specified in Section 06114.

1. Provide nailers at all roof perimeters and penetrations for fastening membrane flashings and sheet metal components.
2. Wood nailers should match the height of any insulation, providing a smooth and even transition between flashing and insulation areas.
3. Nailer lengths should be spaced with a minimum 1/8 inch gap for expansion and contraction between each length or change of direction.
4. Nailers and flashings should be fastened in accordance with Factory Mutual "Loss Prevention Data Sheet 1- 49, Perimeter Flashing" and be designed to be capable of resisting a minimum force of 200 lbs/lineal foot in any direction.

E. Metal Work: Provide metal flashings, counter flashings, parapet coping caps and thru-wall flashings as specified in Section 07620 or Section 07710. Install in accordance with the SMACNA "Architectural Sheet Metal Manual" or the NRCA Roofing Waterproofing manual.

F. Termination Bar: Provide a metal termination bar or approved top edge securement at the terminus of all flashing sheets at walls and curbs. Fasten the bar a minimum of 8 inches (203 mm) o/c to achieve constant compression. Provide suitable, sealant at the top edge if required.

G. Flashing Base Ply: Seal all curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.

1. Prepare all walls, penetrations, expansion joints, and other surfaces to be flashed with asphalt primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
2. Adhere modified flashing base to the underlying base flashing ply with specified flashing ply adhesive. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
3. Solidly adhere the entire sheet of flashing membrane to the substrate. Tops of all flashings that are not run up and over curb shall be secured through termination bar 6 inches (152 mm) and sealed at top
4. Seal all vertical laps of flashing membrane with a three-course application of trowel-grade mastic and fiberglass mesh.
5. Coordinate counter flashing, cap flashings, expansion joints, and similar work with modified bitumen roofing work.
6. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work. When using mineralized cap sheet all stripping plies type IV felt shall be installed prior to cap sheet installation.

H. Flashing Cap Ply: Install flashing cap sheets by the same application method used for the base ply.

1. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
2. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.

3. Adhere to the underlying base flashing ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
4. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
5. Coordinate roof accessories, miscellaneous sheet metal accessory items with the roofing system work.
6. All stripping shall be installed prior to flashing cap sheet installation.
7. Heat and scrape granules when welding or adhering at cut areas and seams to granular surfaces at all flashings.
8. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.

I. Roof Walkways: Provide walkways in areas indicated on the Drawings.

3.5 INSTALLATION EDGE TREATMENT AND ROOF PENETRATION FLASHING

A. Metal Edge:
1. Inspect the nailers to assure proper attachment and configuration.
2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at 8 inches (203 mm) o.c.
3. Install continuous cleat and fasten at 6 inches (152 mm) o.c.
4. Install new metal edge hooked to continuous cleat and set in bed of roof cement. Fasten flange to wood nailers every 3 inches (76 mm) o.c. staggered.
5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry. Do not prime for Green-Lock System lightly sand metal to improve bond.
6. Strip in flange with base flashing ply covering entire flange in bitumen with 6 inches (152 mm) on to the field of roof. Assure ply laps do not coincide with metal laps.
7. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Seal outside edge with rubberized cement.

B. Surface Mounted Counterflashing:
1. Minimum flashing height is 8 inches (203 mm) above finished roof height. Maximum flashing height is 24 inches (609 mm). Prime vertical wall at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering wall set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall. Alternatively use caulk to replace the butyl tape.
6. Secure counterflashing set on butyl tape above flashing at 8 inches (203 mm)

o.c. and caulk top of counterflashing.

C. Reglet Mounted Counterflashing:
1. Minimum flashing height is 8 inches (203 mm) above finished roof height. Maximum flashing height is 24 inches. Prime vertical wall at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering wall set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall. Alternatively use caulk to replace the butyl tape.
6. Cut reglet in masonry one joint above flashing.
7. Secure reglet counterflashing with expansion fasteners and caulk reglet opening.

D. Curb Detail/Air Handling Station:
1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
5. Install pre-manufactured counterflashing with fasteners and neoprene washers or per manufacturer's recommendations.
6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

E. Exhaust Fan:
1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering curb with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply installed over the base flashing ply, 9 inches (228 mm) on to field of the roof. Attach top of membrane to top of wood curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
5. Install metal exhaust fan over the wood nailers and flashing to act as counterflashing. Fasten per manufacturer's recommendation.

F. Passive Vent/Air Intake:
   1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
   2. Set cant in bitumen. Run all plies over cant a minimum of 2 inches (50 mm).
   3. Install base flashing ply covering curb with 6 inches (152mm) on to the field of the roof.
   4. Install a second ply of modified flashing ply installed over the base flashing ply, 9 inches (228 mm) on to field of the roof. Attach top of membrane to top of wood curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
   5. Install passive vent/air intake over the wood nailers and flashing to act as counterflashing. Fasten per manufacturer's recommendations.

G. Roof Drain:
   1. Plug drain to prevent debris from entering plumbing.
   2. Taper insulation to drain minimum of 24 inches (609 mm) from center of drain.
   3. Run roof system plies over drain. Cut out plies inside drain bowl.
   4. Set lead/copper flashing (30 inch square minimum) in 1/4 inch bed of mastic. Run lead/copper into drain a minimum of 2 inches (50 mm). Prime lead/copper at a rate of 100 square feet per gallon and allow to dry.
   5. Install base flashing ply (40 inch square minimum) in bitumen.
   6. Install modified membrane (48 inch square minimum) in bitumen.
   7. Install clamping ring and assure that all plies are under the clamping ring.
   8. Remove drain plug and install strainer.

H. Roof Drain Alternate:
   1. Plug drain to prevent debris from entering plumbing.
   2. Taper insulation to drain minimum of 24 inches (609 mm) from center of drain.
   3. Install two base flashing plies (40 inch square minimum) in bitumen.
   4. Set lead/copper flashing (30 inch square minimum) in 1/4 inch (6 mm) bed of mastic. Run lead/copper into drain a minimum of 2 inches (50 mm). Prime lead/copper at a rate of 100 square feet per gallon and allow to dry.
   5. Run roof system plies over drain. Cut out plies inside drain bowl.
   6. Install modified membrane (48 inch square minimum) in bitumen.
   7. Install clamping ring and assure that all plies are under the clamping ring.
   8. Remove drain plug and install strainer.

I. Plumbing Stack:
   1. Minimum stack height is 12 inches (609 mm).
   2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
   3. Prime flange of new sleeve. Install properly sized sleeves set in 1/4 inch (6 mm) bed of roof cement.
   4. Install base flashing ply in bitumen.
   5. Install membrane in bitumen.
   6. Caulk the intersection of the membrane with elastomeric sealant.
   7. Turn sleeve a minimum of 1 inch (25 mm) down inside of stack.

J. Heat Stack:
   1. Minimum stack height is 12 inches (609 mm).

2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
3. Prime flange of new sleeve. Install properly sized sleeves set in 1/4 inch (6 mm) bed of roof cement.
4. Install base flashing ply in bitumen.
5. Install modified membrane in bitumen.
6. Caulk the intersection of the membrane with elastomeric sealant.
7. Install new collar over cape. Weld collar or install stainless steel draw brand.

K. Liquid Flashing:
1. Mask target area on roof membrane with tape.
2. Clean all non-porous areas with isopropyl alcohol.
3. Apply 32 wet mil base coat of liquid flashing over masked area.
4. Embed polyester reinforcement fabric into the base coat of the liquid flashing.
5. Apply 48-64 wet mil top coat of the liquid flashing material over the fabric extending 2 inches (51 mm) past the scrim in all directions.
6. Apply minerals immediately or allow the liquid flashing material to cure 15-30 days and then install reflective coating.

3.6 CLEANING

A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.

B. Remove asphalt markings from finished surfaces.

C. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.7 PROTECTION

A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.

B. Protect exposed surfaces of finished walls with tarps to prevent damage.

C. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch (16 mm) thick.

D. In addition to the plywood listed above, an underlayment of minimum 1/2 inch (13 mm) recover board is required on new roofing.

E. Special permission shall be obtained from the Manufacturer before any traffic shall be permitted over new roofing.

3.8 FIELD QUALITY CONTROL

A. Inspection: Provide manufacturer's field observations at start-up and at intervals of approximately 30 percent, 60 percent and 90 percent completion. Provide a final inspection upon completion of the Work.
1. Warranty shall be issued upon manufacturer's acceptance of the installation.
2. Field observations shall be performed by a Sales Representative employed full-time by the manufacturer and whose primary job description is to assist,

inspect and approve membrane installations for the manufacturer.

3. Provide observation reports from the Sales Representative indicating procedures followed, weather conditions and any discrepancies found during inspection.
4. Provide a final report from the Sales Representative, certifying that the roofing system has been satisfactorily installed according to the project specifications, approved details and good general roofing practice.

3.9 SCHEDULES

A. Base (Ply) Sheet:
   1. HPR Torch Base: 110 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet reinforced with a fiberglass scrim. Designed for torch applications with a burn-off backer that indicates when the material is hot enough to be installed.
      a. Tensile Strength, ASTM D 5147
         1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 210 lbf/in XD 210 lbf/in
         2) 50 mm/min. @ 23 +/- 2 deg. C MD 36.75 kN/m XD 36.75 kN/m
      b. Tear Strength, ASTM D 5147
         1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 300 lbf XD 300 lbf
         2) 50 mm/min. @ 23 +/- 2 deg. C MD 1,334 N XD 1,334 N
      c. Elongation at Maximum Tensile, ASTM D 5147
         1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 6% XD 6%
         2) 50 mm/min. @ 23 +/- 2 deg. C MD 6% XD 6%
      d. Low Temperature Flexibility, ASTM D5147, Passes -30 deg. F (-34.4 deg. C)

B. Modified Cap (Ply) Sheet:
   1. StressPly IV Plus: 180 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing membrane reinforced with a fiberglass and polyester composite scrim. This membrane is designed for torch applications and has a burn-off backer that indicates when the material is hot enough to be installed.
      a. Tensile Strength, ASTM D 5147
         1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 310 lbf/in XD 310 lbf/in
         2) 50 mm/min. @ 23 +/- 2 deg. C MD 54.25 kN/m XD 54.25 kN/m
      b. Tear Strength, ASTM D 5147
         1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 510 lbf XD 510 lbf
         2) 50 mm/min. @ 23 +/- 2 deg. C MD 2269 N XD 2269 N
      c. Elongation at Maximum Tensile, ASTM D 5147
         1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 9% XD 8%
         2) 50 mm/min. @ 23 +/- 2 deg. C MD 9% XD 8%
      d. Low Temperature Flexibility, ASTM D 5147, Passes -40 deg. F (-40 deg. C)

C. Flashing Base Ply:
   1. HPR Torchbase: SBS modified, torch applied sheet material. ASTM D 6163, Type II.
      a. Tensile Strength, ASTM D 5147
         1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 210 lbf/in XD 210 lbf/in
         2) 50 mm/min. @ 23 +/- 2 deg. C MD 210 lbf/in XD 210 lbf/in

b. Tear Strength, ASTM D 5147
   1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 300 lbf XD 300 lbf
   2) 50 mm/min. @ 23 +/- 2 deg. C MD 1334 N XD 1334 N
c. Elongation at Maximum Tensile, ASTM D 5147
   1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 6 % XD 6 %
   2) 50 mm/min@ 23 +/- 2 deg. C MD 6 % XD 6 %
d. Low Temperature Flexibility, ASTM D 5147:
   1) Passes -30 deg. F (-34 deg. C). Meets or Exceeds ASTM D 4601 Type II Performance Criteria.

D. Surfacing:
1. Flashing Cap (Ply) Sheet:
   a. StressPly IV Plus (UV) Mineral: 195 mil SBS (Styrene-Butadiene-Styrene) mineral surfaced rubber modified roofing membrane with a fiberglass and polyester composite scrim. Designed for torch applications with a burn-off backer that indicates when the material is hot enough to be installed. Surfaced with a highly reflective Sunburst mineral.
      1) Tensile Strength, ASTM D 5147
         a) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 310 lbf/in XD 310 lbf/in
         b) 50 mm/min. @ 23 +/- 2 deg. C MD 54.25 kN/m XD 54.25 kN/m
      2) Tear Strength, ASTM D 5147
         a) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 510 lbf XD 510 lbf
         b) 50 mm/min. @ 23 +/- 2 deg. C MD 2269 N XD 2269 N
      3) Elongation at Maximum Tensile, ASTM D 5147
         a) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 9% XD 8%
         b) 50 mm/min. @ 23 +/- 2 deg. C MD 9% XD 8%
      4) Low Temperature Flexibility, ASTM D 5147, Passes -40 deg. F (-40 deg. C)
      5) Reflectivity, ASTM C 1549: 73%

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide metal flashings and sheet metal including accessories as required for complete weathertight installation.

1. Flashing and sheet metal includes copings, fascia, scuppers, gutters, downspouts, rainwater leaders, reglets, and similar fabricated components as applicable to Project.

a. Provide Schedule 40 hot-dipped galvanized downspouts.

2. Provide concealed sealants used in conjunction with installation of metal flashing and sheet metal.

3. Provide miscellaneous sheet metal flashing and reglets not provided by other trades or suppliers.

a. Where reglets are to be installed in conjunction with other work, provide in adequate time for installation.

b. Where reglets are to be surface applied, provide continuous gasket between reglets and surface.

4. Provide precast concrete splash blocks.

B. Related Sections:

1. Section 06 10 50: Miscellaneous rough carpentry.
2. Section 07 25 00: Concealed flashing at weather-resistive barriers/underlayment.
3. Section 08 91 00: Louvers.

1.2 REFERENCES

A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

1.3 SUBMITTALS

A. Product Data: Furnish literature for manufactured products.

B. Shop Drawings: Clearly indicate dimensioning, layout, general construction details including closures, flashings, locations and types of sealants, anchorages, and method of anchorage.

C. Samples: Furnish samples of typical metal flashing fabrication indicating standard soldered joints and edge conditions.

1.4 DELIVERY, STORAGE AND HANDLING

A. Provide strippable film protective covering on shop finished flashing materials to protect materials through shipping, fabrication, and installation.

1.5 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide flashing and sheet metal including reglets and accessories as required for complete weathertight installation.

B. Design Criteria: Allow for movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100-year seasonal temperature ranges.

C. Flashing and Sheet Metal:

1. Galvanized Steel: ASTM A924 and A653 G90 galvanized steel; minimum 24-gage.

a. Mill phosphatized where indicated to be field painted.

b. Location (Concealed): Where indicated, if not otherwise indicated, provide where flashing will not be exposed to view from exterior of building and where not exposed to view from spaces within building.

c. Steel Pipe Downspouts: ASTM A53, Type S seamless, Schedule 40, with G90 hot-dipped galvanized coating; sizes as indicated.

2. Shop Finished Galvanized Steel Flashing and Sheet Metal: ASTM A924 and A653 G90 galvanized steel; minimum 24-gage; with factory applied fluoropolymer coating based on Kynar 500 or Hylar 5000.

a. Manufacturers:

1) ATAS International/PVDF Coil Coated Galvanized Steel.
2) Ryerson Building Products (800.328.7800)/ColorKlad.
3) Metal Sales Manuf. Corp. (800.406.7387)/PVDF (Kynar 500).
4) K&M Sheet Metal (888.567.7778)/Kynar Steel.
5) Substitutions: Refer to Section 01 25 00.

b. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.

c. Color: As selected by Architect from manufacturer's full range of nonmetallic colors.

d. Touch-up Paint for Prefinished Sheet Metal: Type recommended by fluoropolymer manufacturer for field touch-up.

3. Stainless Steel Flashing and Sheet Metal: Stainless steel, ASTM A666, Type 304, soft annealed, 2B finish, minimum 26-gage.

   a. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.

4. Aluminum and Zinc Alloy Coated Steel Flashing and Sheet Metal: Aluminum-zinc coated steel, ASTM A792, AZ55 coating; minimum 24 gage steel; coating to contain 55% aluminum, 43.5% zinc, and 1.5% silicon, or 55% aluminum and 45% zinc.

   a. Trade Names: Galvalume and Zincalume.

   b. Location (Exposed): Where indicated, if not otherwise indicated, provide where flashing will be exposed to view from exterior of building, and where exposed to view from spaces within building.

5. Zinc Alloy: Zinc/copper/titanium alloy conforming to ASTM B69; not less than 0.025” thick.

   a. Manufacturers:

      1) Rheinzink America, Inc./Rheinzink.
      2) VM Building Solutions/VM Quartz Zinc.
      3) Substitutions: Refer to Section 01 25 00.

   b. Color: As selected by Architect from manufacturer’s full range of colors including bright, blue gray, and graphite gray.

6. Mill Finished Aluminum: ASTM B209, 3003-H14, minimum thickness 0.040” unless otherwise indicated.

7. Anodized Aluminum Sheet: ASTM B209, 5005-H14, with minimum thickness of 0.050” unless otherwise indicated.

   a. Clear Anodized Coating: AAMA 607.1 clear anodized, Architectural Class I 0.018mm or thicker coating.

   b. Color Anodized Coating: AAMA 608.1, Architectural Class I 0.018mm or thicker coating; color as indicated on Drawings.

8. Extruded Aluminum: ASTM B221, alloy 6063-T52, with minimum thickness of primary legs 0.080” unless otherwise indicated; clear anodized unless otherwise indicated.

9. Prefinished High-Performance Coated Aluminum: Manufacturer's standard two coat thermocured fluoropolymer system containing not less than 70-percent polyvinylidene fluoride resin by weight; AAMA 2605 and AA-C12C42R1x.

    a. Manufacturers:

        1) ATAS International/PVDF Coil Coated Aluminum.
        2) Ryerson Building Products (800.328.7800)/AlumaKlad.
        3) Merchant & Evans Industries, Inc. (800.257.6215)/Custom.
        4) Substitutions: Refer to Section 01 25 00.

    b. Color and Gloss: As selected by Architect from manufacturer's full range of nonmetallic colors.

    c. Touch-up Paint for Prefinished Sheet Metal: Type recommended by fluoropolymer manufacturer for field touch-up.

10. Lead Flashing: ASTM B749, type L51121, copper-bearing sheet lead, minimum four pound per square foot (1/16" thick) lead with 6% to 7% antimony content.

11. Accessories: Provide strainers, outlet tubes, screens, baffles, hangers, and gutter ends as required for a complete system and complying with SMACNA Manual.

12. Heavier Gage Metals: Where recommended by SMACNA Manual for size of component, provide heavier gage as recommended.

D. Manufactured Reglets: Snap-on type, for two-piece flashing; metal to match flashing and sheet metal.

    1. Manufacturers:

        a. Fry Reglet Corp./Springlok System.
        b. W.P. Hickman Co./The Leading-Edge Drive Lock System.
        c. Substitutions: Refer to Section 01 25 00.

E. Solder and Fasteners: As recommended by SMACNA and complying with applicable codes and regulations; hot dipped galvanized minimum coating comparable to G90.

F. Concealed Sealant: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.

G. Bituminous Paint: Acid and alkali resistant type; black color; asbestos free.

H. Plastic Cement: Cutback asphaltic type; asbestos free.

I. Sealing Compound: Type recommended by roofing manufacturer; asbestos free.

J. Gaskets: Type suitable for use in conjunction with sheet metal; non-staining, non-corrosive, non-shrinking, non-sagging, ultra-violet resistant, and ozone resistant; for exterior concealed applications.

    1. Manufacturers:

a. EMSEAL, a Sika Co./EMSEAL MST Multi-Use Sealant Tape.
b. Substitutions: Refer to Section 01 25 00.

K. Splash Blocks: Precast concrete size and profile as approved by Architect for specific applications; minimum 2000 psi at 28 days with minimum 5% air entrainment.

2.2 FABRICATION

A. Fabricate sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

B. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

1. Fabricate corners and intersections in shop with solder joints for watertight fabrication.

C. Form sections in maximum 10'-0" lengths; make allowance for expansion at joints.

D. Hem exposed edges on underside 1/2".

E. Back-paint flashings with heavy bodied bituminous paint where in contact with cementitious materials or dissimilar metals.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with SMACNA Architectural Sheet Metal Manual recommendations for examination and preparation of substrates to receive flashing and sheet metal.

B. Install flashing and sheet metal over surfaces that are dry, free of ridges, warps and voids that could damage underlayment.

C. Coordinate installation with installation of underlayment specified in Section 07 25 00 – Weather-Resistive Barriers underlayment; take special care not to damage underlayment beyond that required to secure flashing and sheet metal in place.

3.2 INSTALLATION

A. Install metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Install tight in place, with corners square, surfaces true and straight in planes, and lines accurate to profiles as indicated on Drawings.

2. Lap joints in direction of water flow.

3. Hold downspouts in position, clear of wall, by hangers spaced not more than 10'-0" on center; securely fasten hangers to wall without visible damage to wall surface.

B. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.

C. Provide expansion joints concealed within system.

D. Use concealed fasteners, continuous cleat type, except where specifically approved by Architect.

1. Exposed fasteners may be used, where clearly indicated on shop drawings and approved by Architect, at areas not exposed at exterior walls nor in sight of interior spaces.

E. Apply sealing compound at junction of metal flashing and felt flashing.

F. Lock seams and end joints; fit flashing tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Counter-flash mechanical and electrical items projecting through roof membrane.

H. Install sealants where required to prevent direct weather penetration.

1. Install continuous gasket behind surface applied reglets.

I. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.

J. Install splash blocks at locations to interrupt fall of water and direct water flow as indicated on Drawings.

3.3 CLEANING

A. Remove protective coating from shop finished sheet metal when no longer required to protect roofing and flashing from construction.

B. Touch-up scratched and damaged finish to match new; remove and replace sheet metal units that cannot be repaired to look identical to adjacent sheet metal when viewed from 15'-0" away.

END OF SECTION

SECTION 07 90 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide joint sealants, for interior and exterior joints not specified elsewhere, with backing rods and accessories as required for complete installation.

1. Joint sealants include joint sealers and calking as indicated.

B. Related Sections:

1. Section 07 60 00: Flashing and sheet metal concealed sealants.
2. Section 07 84 00: Firestopping type joint sealants.
3. Section 08 80 00: Glazing sealants.
4. Section 09 21 00: Sealants used for acoustic treatment at gypsum board.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: System requires coordination of sealants with multiple substrates, some required to accept bond, some required to prevent bond.

1. It shall be responsibility of this Section to ensure substrates are suitable for providing bond or preventing bond as required for proper sealant installation and longevity.

2. Where substrates are not suitable provide materials as required to ensure bond such as primers and to prevent bond such as bond-breakers.

3. Coordinate with Architect where change of detail or sealant type is required to ensure proper sealant installation.

B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's descriptive literature.

B. Samples: Furnish samples of each type of exposed joint sealer in required colors.

C. Certifications:

1. Furnish manufacturer's certification joint sealers comply with Contract Documents and are suitable for Project applications.

2. Furnish certification indicating installers are trained in proper use of specified products, qualified, and familiar with proper installation techniques.

D. Installer Qualifications: Firm with minimum five years' successful experience on projects of similar type and size, using specified products.

1. Installers shall be familiar with proper application procedures to ensure maximum joint sealer expansion and contraction capabilities.

E. Mock-Up: Provide exterior joint sealers where required for mock-ups of other systems.

F. Field-Adhesion Pull Tests: Before installing sealants, field pull test adhesion to joint substrates by testing laboratory with not less than ten-years successful experience doing pull testing specified.

1. Conduct field pull tests for each kind of exterior wall sealant and joint substrate.

2. Arrange for pull tests to take place with -sealant manufacturer's technical representative present.

3. Test Method: ASTM C1193, Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1, or ASTM C1521 Tail Procedure.

a. Verify adhesion for joints with dissimilar substrates for each substrate separately.

4. Report where sealant failed to adhere to joint substrates or tore cohesively. Sealants that fail adhesively to be retested until satisfactory adhesion is obtained.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, cure time, and mixing instructions.

1.5 SITE CONDITIONS

A. Do not proceed with installation of joint sealers under unfavorable weather conditions.

B. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer.

1.6 WARRANTY

A. Extended Correction Period: Extend correction period to two years.

1. Repair or replace joint sealers which fail to perform as intended, because of leaking, crumbling, hardening, shrinkage, bleeding, sagging, staining, loss of adhesion, and loss of cohesion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide joint sealants with backing rods and accessories.

B. Performance Requirements:

1. Select materials for compatibility with joint surfaces and indicated exposures.

2. Where not indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.

3. Comply with applicable limitations on volatile organic compound (VOC) emissions.

C. Regulatory Requirements: Comply with applicable regulatory requirements regarding limitations on volatile organic compound (VOC) emissions limitations.

D. Elastomeric Sealants:

1. Single Component Low Modulus Silicone Sealant: ASTM C920 Type S, Class 25, Grade NS; minimum 50% expansion and compaction capability.

   a. Provide at silicone sealant at exterior locations not exposed to traffic.

   b. Manufacturers:

      1) GE (Momentive Performance Materials)/Silpruf or Silglaz.
      2) Dow/Dowsil 790, 791, or Dowsil 795.
      3) Pecora Corp./864 Architectural Silicone.
      4) Tremco/Spectrem 3.
      5) Substitutions: Refer to Section 01 25 00.

2. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade NS, Class 25, non-sag; minimum 25% expansion and compaction capability.

   a. Provide at multi-component polyurethane sealant at exterior locations not exposed to traffic.

   b. Manufacturers:

      1) Pecora Corp./Dynatrol II.
      2) Tremco/Dymeric 240.
      3) BASF/MasterSeal NP 2.
      4) Substitutions: Refer to Section 01 25 00.

3. Single Component Low Modulus Sealant: ASTM C920 Type S, Class 35, Grade NS; minimum expansion and compaction capability.

   a. Provide at low modulus sealant at exterior locations not exposed to traffic.

   b. Manufacturers:

      1) Fortifiber Building Systems Group/Moistop Sealant.
      2) Sika Group/SikaFlex 1A+.
      3) Substitutions: Refer to Section 01 25 00.

4. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade P, Class 25, self-leveling; minimum 25% expansion and compaction capability.

    a. Provide multi-component polyurethane sealant at traffic bearing locations.

    b. Manufacturers:

        1) Pecora Corp./Urexpan NR-200, or Dynatrol II-SG.
        2) Tremco/THC 900-901, or Vulkem 445 SSL.
        3) BASF/MasterSeal SL 2
        4) Substitutions: Refer to Section 01 25 00.

5. Mildew-Resistant Silicone Rubber Sealant: ASTM C920, Type S, Grade NS, Class 25, compounded with fungicide, specifically for mildew resistance and recommended for interior joints in wet areas.

    a. Provide mildew-resistant silicone sealant at interior joints in wet areas.

    b. Manufacturers:

        1) GE (Momentive Performance Materials)/SCS 1702 Sanitary Sealant.
        2) Dow/786 Bathtub Caulk.
        3) Pecora Corp./898 Sanitary Mildew Resistant Sealant.
        4) Tremco/Tremsil 200.
        5) Substitutions: Refer to Section 01 25 00.

E. Non-Elastomeric Sealants:

1. Acrylic-Emulsion Sealant: ASTM C834 acrylic or latex-rubber-modified acrylic sealant, permanently flexible, non-staining, and non-bleeding; recommended for general interior exposure; compatible with paints specified in Section 09 90 00.

    a. Provide paintable acrylic sealant at general interior applications.

    b. Manufacturers:

        1) Pecora Corp./AC-20.
        2) Tremco/Tremflex 834.
        3) Substitutions: Refer to Section 01 25 00.

2. Air Seals: Provide non-staining and non-bleeding sealers, calks, or foams appropriate to specific applications for filling openings between conditioned and unconditioned spaces.

    a. Types: As recommended by manufacturers for each specific application; materials to be compatible with adjacent materials.

    b. Manufacturers:

        1) Dow/Great Stuff.
        2) Owens Corning/EnergyComplete Air Sealant.
        3) Hilti/Foam Filler CF 812.
        4) Substitutions: Refer to Section 01 25 00.

c. Pest Control Mesh: Openings subject to pest infiltration to have 304 stainless steel wool, material stuffed in joint before application of air seals using methods to ensure blocking of gap from pests.

d. Exception: Annular spaces around pipes, electric cables, conduits, and other openings in exterior walls shall be protected against passage of rodents by closing with cementitious grout.

1) Cementitious Grout: ASTM C1107 non-shrink, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.

F. Miscellaneous Materials: Provide as indicated, as recommended by manufacturers, and as required for complete joint sealant installation.

1. Primers/Sealers: Non-staining types recommended by joint sealer manufacturer for joint surfaces to be primed or sealed.

2. Joint Cleaners: Non-corrosive types recommended by joint sealer manufacturer; compatible with joint forming materials.

3. Bond Breaker Tape: Polyethylene tape as recommended by joint sealer manufacturer where bond to substrate or joint filler must be avoided for proper performance of joint sealer.

4. Sealant Backer Rod: Closed cell compressible polyethylene foam rod or other flexible, permanent, durable non-absorptive material as recommended by joint sealer manufacturer for compatibility with joint sealer.

a. Oversize backer rod minimum 30% to 50% of joint opening.

G. Colors: As indicated, as selected by Architect from manufacturer's full range of colors where not indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare joint surfaces in accordance with ASTM C1193 and as recommended by joint sealer manufacturer.

B. Clean joint surfaces immediately before installation of joint sealer; remove dirt, insecure materials, moisture, and other substances which could interfere with bond of joint sealer.

C. Prime or seal joint surfaces when recommended by joint sealer manufacturer; do not allow primer/sealer to spill or migrate onto adjoining surfaces.

D. Ensure protective coatings on surfaces in contact with joint sealers have been completely stripped.

3.2 INSTALLATION

A. Comply with manufacturer's printed instructions and ASTM C1193, except where more stringent requirements are shown or specified.

B. Pest Control: Install stainless steel wool prior to application of backer rods and bond breakers at air seal and as required to ensure complete pest blockage at joints where pest intrusion is a potential.

C. Set sealant backer rods at proper depth or position in joint to coordinate with other work, including installation of bond breakers and sealant; do not leave voids or gaps between ends of backer rods.

1. Do not stretch, twist, puncture, or tear backer rods.

D. Install bond breaker tape as required to avoid three-sided bond of sealant to substrate and where required by manufacturer's recommendations to ensure joint sealers will perform properly.

E. Size materials to achieve required width/depth ratios.

F. Employ installation techniques that will ensure joint sealers are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of bond surfaces equally on opposite sides.

G. Joint Configuration: Fill sealant joint to a slightly concave surface, slightly below adjoining surfaces, unless otherwise indicated.

H. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture or dirt.

I. Install joint sealers to depths recommended by joint sealer manufacturer but within the following general limitations, measured at center (thin) section of bead.

1. Horizontal Joints: 75% width with minimum depth of 3/8".
2. Elastomeric Joints: 50% width with minimum depth of 1/4".
3. Non-Elastomeric Joints: 75% to 125% of joint width.

J. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.

1. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

K. Cure joint sealers in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.

L. Maintain finished joints free of embedded matter, ridges, and sags.

END OF SECTION

SECTION 08 11 10

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide full flush steel (hollow metal) doors and pressed steel frames, including anchors and silencers.

1. Pressed steel frames

B. Related Sections:
1. Section 08 71 00: Door hardware.
2. Section 08 80 00: Glazing.

1.2 REFERENCES

A. Steel Door Institute (SDI): SDI-100 (ANSI/SDI A250.8) - Recommended Specifications - Standard Steel Doors and Frames.

B. National Association of Architectural Metal Manuf. (NAAMM): Hollow Metal Manual.

C. Underwriters Laboratories: Standards as applicable to fire rated doors and frames.

1. Materials tested, labeled, and inspected by Warnock Hersey International are acceptable upon approval of authorities.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate hardware installation with Section 08 71 00 – Door Hardware.

2. Coordinate glass installation with Section 08 80 00 - Glazing.

1.4 SUBMITTALS

A. Product Data: Submit manufacturers' literature.

B. Shop Drawings: Indicate general construction, configuration, jointing methods, reinforcement, anchorage methods, hardware locations, and locations of cut-outs.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Ceco Door Division Assa Abloy Door Group.

B. Curries Division Assa Abloy Door Group.

C. Door Components, Inc.

D. Republic Doors and Frames.

E. Krieger Steel Products Co.

F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide full flush steel (hollow metal) doors and pressed steel frames, including anchors and silencers.

B. Doors: Hollow metal flush steel door, 1-3/4" thick unless otherwise indicated.

1. Typical: Full flush with steel channel or welded edge; close top with flush end closer treatment, bottom optional flush, or recessed channel; steel stiffened core, insulated at exterior doors; continuous welded seam.

2. Doors: Minimum 0.053” (16-gage).

C. Frames:

1. Exterior Frames: Welded (pre-assembled) type.

2. Alternate Frames: Knockdown (field-assembled) type; provide 3/8” back bend return on frames at gypsum board.

3. Gage: Minimum 0.053” (16-gage) interior frames, 0.067” (14-gage) exterior frames.

4. Door Silencers: Manufacturer's standard resilient type; removable for replacement.

3. Mortar Guard Boxes: Minimum 0.026” (22-gage) mortar guard boxes welded in place; provide where frames may be grouted.

D. Glazing Stops: Full flush type with glass centered in opening, unsecured side integral with unit, secured side fastened with flush, countersunk Allen type fasteners; minimum 0.053” (16-gage).

~~E. Fire Rated Units: Construct in accordance with requirements for fire rating, NFPA 252 or UL 10C, and NFPA 80.~~

~~1. Labels: Place fire rating labels where visible when doors and frames are in installed, opened position.~~

~~2. Fire Ratings: Refer to Drawings for fire rating requirements.~~

~~3. Temperature Rise Rating: Provide doors with maximum 450°F Temperature Rise Rating in 30-minute fire exposure period at doors into exit enclosures and where otherwise required by applicable codes.~~

~~F. Door Louvers:~~

~~1. Interior Doors: Stationary, sight-proof hood or Y type blades of 24-gage steel inserted into door panels full door thickness; no exposed trim.~~

~~2. Exterior Doors: Weatherproof Z-shaped blades with U-shaped frames; 1-3/8" thick; blades 1-1/2" on center; 0.053" (16 gage) welded construction.~~

~~a. Provide removable bird screens on interior faces, 1/2" by 1/2" bronze wire mesh.~~

2.3 FABRICATION

A. Conform to requirements of SDI (ANSI A250 Series) or NAAMM.

B. Reinforce and prepare doors and frames to receive hardware.

1. Refer to Section 08 71 00 for hardware requirements.

C. Frames:

1. Welded Frames: Accurately form and cut mitered corners of welded type frames; continuously weld on inside surfaces (fully welded); grind welded joints to smooth uniform finish.

2. Knocked Down Frames: Accurately form and miter interlocking joints of knocked down frames to maintain hairline alignment of parts when field assembled.

3. Head Reinforcement: Reinforce frames wider than 4'-0" with minimum 0.093" (12 gage) formed steel channels welded in place, flush with top of frames.

4. Doors at Glazed Panels: Reinforce jambs and heads of frames for doors which occur adjacent to glazed sidelights and partitions.

D. Door Silencers:

1. Place three single bumpers on single door frames; space equally along strike jambs.

2. Place two single bumpers on double door frames; place on frame heads.

3. Place three single bumpers for each door; located on door frames; with removable mullions, spaced equally along strike jambs, and in addition place two single bumpers on frame heads to cushion door when mullion is removed.

E. Provide jamb anchors per SDI-100 (ANSI/SDI 250.8) and NAAMM and weld floor jamb anchors in place.

F. Provide double doors tested and approved without astragals.

1. Provide astragals for double doors when required to meet UL requirements for Class A, 3-hour rated doors only.

G. Edge Clearances:

1. Between Doors and Frames: Maximum 1/8" at head and jambs.
2. Door Sills (No Threshold): Maximum 1/2".
3. Door Sills (Threshold): Maximum 3/8" above finished floor.
4. Between Edges of Pairs of Doors: Maximum 1/8".
5. Fire Rated Doors: As required for fire ratings.

H. Finish: Comply with requirements of Section 09 90 00 – Painting and Coating for primer including application and compatibility with specified finishes.

1. Interior Units: Prime paint.

2. Exterior Exposed Units: Apply minimum A60 non-spangle galvanized coating, ASTM A924 and A653.

a. Surface treat after galvanizing to remove oils and prepare for painting and apply one coat of primer; comply with requirements in Section 09 90 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors and frames in accordance with SDI-100 (ANSI/SDI A250.8) and ANSI/SDI A250.11 or NAAMM "Hollow Metal Manual" and with manufacturer's recommendations and installation instructions.

1. Install fire rated units in conformance with fire label requirements and NFPA 80.

B. Install doors and frames plumb and square within 1/16”, and with maximum diagonal distortion of 1/32".

C. Remove and replace doors and frames damaged during delivery, storage, installation, and construction.

1. Paste filler repair shall not be permitted.

D. After installation, touch-up scratched paint surfaces.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide access doors set in finished surfaces.

1. Provide access doors and panels as required for access to controls and valves behind finished surfaces.

2. Coordinate with various trades for controls and valves which may be concealed.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

B. Shop Drawings: Indicate locations of access doors required but not indicated on Architectural Drawings.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Milcor Inc.

B. Nystrom Building Products.

C. J.L. Industries.

D. Karp Associates, Inc.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide access doors and panels set in finished surfaces.

B. Regulatory Requirements: Where doors and panels are in fire rated assemblies provide assemblies listed in Underwriters Laboratories, Inc. "Classified Building Materials Index" for rating shown.

1. Provide UL label on each rated access door.

2. Materials tested, labeled, and inspected by Warnock Hersey International are acceptable upon approval of authorities.

C. Access Doors and Panels: Provide access door and panel assemblies consisting of an integral unit with flush metal doors and panels, complete and ready for installation.

1. Non-Fire Rated Units: Flush panel access doors; provide type with frame flange concealed in finished construction.

2. Fire Rated Units: Manufacturer's standard UL rated insulated flush doors with 1" flanged frame and self-closing mechanism.

3. Stainless steel units at all restrooms and at kitchen area.

D. Frames: Fabricate from not less than 16-gage steel.

E. Doors: Flush panel type, fabricate from not less than 14-gage steel.

F. Hinges: Provide either concealed or continuous piano type hinge.

G. Locking Devices: Provide flush, key-operated cylinder lock for each access door; provide two keys per lock and key locks alike, unless otherwise scheduled.

H. Finish: Finish with manufacturer's factory-applied enamel prime coat applied over phosphate coating on steel.

2.3 FABRICATION

A. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly from sizes shown or scheduled.

B. Fabricate units of continuous welded steel construction and grind welds smooth and flush with adjacent surfaces.

C. Provide attachment devices and fasteners of type required for specific job conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which access doors are to be installed.

1. Do not proceed with work until unsatisfactory conditions are corrected; installation signifies acceptance of conditions.

B. Obtain specific locations and sizes for access doors from trades requiring access to concealed equipment. Coordinate installation with work of other trades.

3.2 INSTALLATION

A. Comply with manufacturer's installation instructions for access doors.

1. Install fire rated access doors in accordance with applicable code requirements and with requirements of NFPA 80.

B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

C. Adjust hardware and doors after installation for proper operation.

3.3 PROTECTION

A. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY**:**

A. Section Includes:

1. Door hardware.
2. Gate Hardware.
3. Cylinders for doors fabricated with locking hardware.

B. Related Divisions:

1. Division 06 – door hardware installation
2. Division 07 – sealant at exterior thresholds
3. Division 08 – metal doors and frames.

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.

1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs.
4. Toilet accessories, including grab bars.
5. Installation.

1.2 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. 2022 California Building Code
   a) Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing
4. DHI – Door and Hardware Institute
5. UL – Underwriters Laboratories
   a) UL 305 – Panic Hardware
6. WHI – Warnock Hersey Incorporated State of California Building Code
7. Local applicable codes
8. SDI – Steel Door Institute
9. 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.

1.3 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.

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. 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.

1.4 QUALITY ASSURANCE**:**

A. Qualifications**:**

1. Hardware supplier**:** direct factory contract supplier who employs a hardware consultant, 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. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

1.5 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.

1.6 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. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
6. 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.

1.7 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**:**	Ten years
2.	Exit Devices**:**	Five years mechanical
3.	Closers**:**	Thirty years mechanical
4.	Hinges**:**	One year
5.	Other Hardware	Two years

1.8 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.

1.9 REGULATORY REQUIREMENTS**:**

A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2022 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. 2022 California Building Code Section 11B-309.4.
2. Force required to activate the operable parts: 5.0 pounds maximum, per 2022 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 2022 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 2022 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 2022 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. 2022 California Building Code Section 11B-404.2.3.

1. Exception: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2022 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 2022 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). 2022 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 2022 California Building Code Section 11B-703.4.2.

PART 2 - PRODUCTS

2.1 MANUFACTURERS**:**

A. Manufacturers and their abbreviations used in this schedule**:**

GLY	Glynn-Johnson Hardware
IVE	H. B. Ives
LOC	Locinox
LCN	LCN Closers
ROC	Rockwood
SAR	Sargent
SCH	Schlage Lock Company
TRI	Trimco Manufacturing
ZER	Zero International

2.2 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 and security studs.
2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS**:**

A. Mortise Locksets and Latchsets**:** as scheduled.

1. Chassis**:** cold-rolled steel, handing field-changeable without disassembly.
2. Universal lock case – 10 functions in one case.
3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
4. Latchbolts**:** 0.75 inch throw stainless steel anti-friction type.
5. 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.
    b) Inside lever applied by screwless shank mounting – no exposed trim mount screws.
    c) Levers rotate up or down for ease of use.
6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.

7. Turnpieces**:** accessible offset turn-lever design not requiring pinching or twisting motions to operate.
8. Strikes**:** 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
9. Scheduled Lock Series and Design**:** Schlage L series, 06A design.
10. Certifications**:**
    a) ANSI A156.13, Grade 1 Operational.
    b) ANSI/ASTM F476-84 Grade 31 UL Listed.
11. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2022 11B-404.2.7 and 11B-309.4.

2.4 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. Accessibility: Require not more than 5 lb to retract the latchbolt, per CBC 2022 11B-404.2.7 and 11B-309.4.

B. Specific features**:**

1. Non-Fire Rated Devices**:** cylinder dogging.

2.5 CLOSERS**:**

A. Surface Closers**:** 4040XP

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 2022 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.
12. Pressure Relief Valves (PRV) not permitted.

2.6 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. Seals**:** Four-fingered type at head & jambs. Inelastic, rigid back, not subject to stretching. Self-compensating for warp, thermal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.
1. Proposed substitutions**:** submit for approval.
2. Three-fingered type at hinge jambs of doors fitted with continuous hinges where jamb leaf of hinge is fastened to the frame reveal.

F. Thresholds**:** As scheduled and per details. Comply with CBC 2022 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. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
4. 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.

G. 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.

2.7 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.

C. Finish designators used in appended hardware schedule**:**

2.8 KEYING REQUIREMENTS**:**

A. Key System**:** Schlage Everest utility-patented keyway, interchangeable core. Utility patent protection to extend at least until 2029. 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

3.1 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.

3.2 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.
1. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1010.1.9.2 and 11B-404.2.7.
2. Locate panic hardware between 36 inches to 44 inches above the finished floor.

C. Overhead stops**:** before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

3.3 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 that 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.

3.4. 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 door closers per 1.9 this section.

B. 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.

3.5 DEMONSTRATION**:**

A. Demonstrate mechanical hardware, including adjustment and maintenance procedures.

3.6 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.

3.7 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.

C. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

Opt. #: OPT0487589-V2

HARDWARE GROUP NO. 01
Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP		630	IVE
1	EA	CORRIDOR LOCK	L9456T 06A 09-544		626	SCH
1	EA	LOCK GUARD	5000-T		626	TRI
1	EA	FSIC CORE	30-120		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 SPEC		689	LCN
1	EA	PROTECTION PLATE	KO 10X2 LDW-CSK		630	TRM
1	EA	STOP HEAVY DUTY	1209/1209-3 AS REQUIRED		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	547A-223(OR AS REQ'D. OR PER DETAIL/CONDITIONS)		A	ZER

HARDWARE GROUP NO. 01.1
Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP		630	IVE
1	EA	CORRIDOR LOCK	L9456T 06A 09-544		626	SCH
1	EA	LOCK GUARD	5000-T		626	TRI
1	EA	FSIC CORE	30-120		626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH ST-1595 SPEC		689	LCN
1	EA	PROTECTION PLATE	KO 10X2 LDW-CSK		630	TRM
1	EA	STOP HEAVY DUTY	1209/1209-3 AS REQUIRED		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	547A-223(OR AS REQ'D. OR PER DETAIL/CONDITIONS)		A	ZER

HARDWARE GROUP NO. 02 - Not Used

HARDWARE GROUP NO. 03
Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	CORRIDOR LOCK	L9456T 06A 09-544	626	SCH
1	EA	LOCK GUARD	5000-T	626	TRI
1	EA	FSIC CORE	30-120	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	PROTECTION PLATE	KO 10X2 LDW-CSK	630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	8192AA	AA	ZER
1	EA	THRESHOLD	547A-223(OR AS REQ'D. OR PER DETAIL/CONDITIONS)	A	ZER

HARDWARE GROUP NO. 04
Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW SH 5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	LOCK GUARD	5000-T	626	TRI
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH ST-1595 SPEC	689	LCN
1	EA	PROTECTION PLATE	KO 10X2 LDW-CSK	630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	8192AA	AA	ZER
1	EA	THRESHOLD	547A-223(OR AS REQ'D. OR PER DETAIL/CONDITIONS)	A	ZER

HARDWARE GROUP NO. 05
Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	PROTECTION PLATE	KO 10X2 LDW-CSK	630	TRM
1	EA	UNIV.DR.STOP/SEC.SCREWS	1215-CKU	626	TRM
1	EA	DOOR SEAL	188SBK PSA (HEAD AND JAMBS)	BK	ZER

HARDWARE GROUP NO. 06
Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	LOCK GUARD	5000-T	626	TRI
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH ST-1595 SPEC	689	LCN
1	EA	PROTECTION PLATE	KO 10X2 LDW-CSK	630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	8192AA	AA	ZER
1	EA	THRESHOLD	547A-223(OR AS REQ'D. OR PER DETAIL/CONDITIONS)	A	ZER

HARDWARE GROUP NO. 07 - Not Used

HARDWARE GROUP NO. 08
Provide each PR door(s) with the following:

2	SET	GATE HINGE/CLOSER	MAMMOTH-180		689	LOC
1	EA	MULLION	FIXED CENTER MULLION BY GATE MANUFACTURER, SUPPLIER			B/O
1	EA	EXIT DEVICE	16-43-8810-TB		630	SAR
1	EA	EXIT DEVICE	16-43-LC-8804-LESS TRIM-TB		630	SAR
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
2	EA	MORTISE CYLINDER (DOGGING)	20-061 ICX XQ11-948 36-083		626	SCH
3	EA	FSIC CORE	23-030		626	SCH
1	EA	VANDAL TRIM	VRT22 X SAR 80 SERIES		630	ROC
1	EA	VANDAL TRIM	VRT22C X SAR 80 SERIES		630	ROC
1	EA	STOP HEAVY DUTY	1209/1209-3 AS REQUIRED		630	TRM
1	SET	NOTE	REMAINDER OF HARDWARE BY GATE MANUFACTURER/SUPPLIER			B/O

END OF SECTION

SECTION 08 91 00

LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide metal louvers and frames, with screens, attachment hardware, and accessories as required for complete finished installation.

B. Related Sections:

1. Section 08 11 10: Steel door louvers.

2. Section 01 11 07: Wildland Urban Interface Fire Area

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of louver.

B. Shop Drawings: Indicate profile of frame, details, relation to adjacent construction, flashing, blade configuration, duct work connection, screens, and percentage of free air opening.

C. Samples: Furnish samples of metal finish.

D. Certificates: Where performance requirements are included, provide AMCA Certified Rating Seal indicating louvers comply with requirements.

1.3 SITE CONDITIONS

A. Take site dimensions affecting louvers prior to fabrication.

B. Ensure openings are properly prepared and flashings are correctly located to divert moisture to exterior.

C. Protect adjacent surfaces, finishes and materials from damage during installation of louvers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The Airolite Corporation.

B. Construction Specialties, Inc. (CSI).

C. Airline Products Co.

D. Nystrom Building Products.

E. Ruskin.

F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide metal louvers and frames, with screens, attachment hardware, and accessories.

B. Performance Criteria: Where indicated, comply with specific performance requirements; unit performance ratings determined in compliance with Air Movement and Control Association (AMCA) Standard 500.

1. Free Area: Minimum 45% based on 48" by 48" louver.

2. Static Pressure Loss: Maximum 0.15" of water gage at airflow of 1000 fpm free air velocity.

3. Water Penetration: Maximum 0.05 oz/sf of free area at intake airflow of 1000 fpm free area velocity.

4. Wind-Driven Rain: Louvers shall achieve a wind-driven rating in conformance with applicable codes and regulations but not less than an A rating on a standard size louver as defined in AMCA 500 - L.

C. Aluminum Extrusions: ASTM B221, 6061 or 6063 alloy, T5 or T6 temper; minimum 0.08" thick.

D. Aluminum Sheet: ASTM B209, manufacturer's standard alloy; minimum 0.08" thick.

E. Steel Sheet: Minimum 16 gage steel, ASTM A924 and A653 with G90 galvanized coating, mill phosphatized.

F. Stainless-Steel Sheet: ASTM A666 Type 304, with No. 4 finish; minimum 18 gage.

2.1 FABRICATION

A. Louvers: Manufacturer's standard fabrication for specified types and configurations indicated on Drawings.

1. Extruded Louvers: Aluminum louvers, fixed blade mullion type.

2. Extruded Louvers: Aluminum louvers, continuous blade (mullionless) type.

3. Formed Sheet Metal Louvers: Shapes as indicated; Contractor option aluminum sheet or galvanized steel sheet unless otherwise indicated.

B. Screen for Exterior Louvers: Minimum 0.063" diameter wire, interwoven square mesh to resist flying embers

1. Wire: Stainless-steel.
2. Frame: Match louver.

C. Fabricate louvers to maximum extent possible and disassemble as necessary for shipping and handling limitations; clearly mark units for reassembly and installation.

1. Fabricate frames, including integral sills, to suit adjacent construction with tolerances for installation.

2. Fabricate sill extension, flashings, wall anchors, structural supplementary sub-framing, and accessories as required for complete system; use same materials as provided for louvers.

D. Join frame members and louver blades by welding; maintain equal blade spacing, including separation between blades and frame head and sill; maintain uniform appearance.

1. Shop miter and weld blades into shop fabricated corner units to align with straight sections; include concealed bracing.

E. Shop Finished Louvers: Factory finish with fluoropolymer coating based on Kynar 500 or Hylar 5000 and conforming with AAMA 2605; not less than two coat system.

1. Color: As indicated, as selected by Architect from manufacturer’s full range of nonmetallic colors where not otherwise indicated.

a. Custom color may be required to match other exposed aluminum components.

F. Shop Primed Louvers: Manufacturer's standard thermosetting prime coating compatible with paints specified in Section 09 90 00 - Painting and Coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install louvers in accordance with manufacturer recommendations and installation instruction, properly aligned and level.

B. Secure louver rigid with concealed fasteners of non-corrosive metals to suit materials being encountered and to resist anticipated loads.

C. Coordinate installation method with application of adjacent backing and structural elements, and mechanical work.

D. Set and tie into flashings to ensure diversion of moisture to exterior.

E. Hinge screens for access.

END OF SECTION

SECTION 09 21 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide gypsum board systems including gypsum board, joint treatment, acoustic accessories, and general accessories for complete installation.

B. Related Sections:
1. Section 09 30 00: Cementitious backer unit tile substrates.

1.2 REFERENCES

A. ASTM C840: Application and Finishing of Gypsum Board.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination,

1. Openings: Obtain dimensions and locations from other trades and provide openings and enclosures for accessories, specialties, equipment, and ductwork.

2. Large Format Tile: Tile Council of North America (TCNA) requires framing at large format tile to be maximum 16” on center and for maximum deflection of L/720 where large format tile as defined by TCNA is indicated.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for framing, insulation, gypsum board, and acoustic accessories.

B. Samples: Submit samples of special texture finish.

C. Manufacturer’s Certification: Furnish manufacturer's certification indicating products comply with Contract Documents and applicable codes.

1. *CAL*Green: Submit additional information as necessary to verify compliance with requirements.

1.5 QUALITY ASSURANCE

A. Level 4 Finish Mock-Up: Provide Level 4 finish mock-up not less than 100 square feet in location acceptable to Architect. Approved mock-up may be incorporated into Project.

1.6 SITE CONDITIONS

A. Do not begin installation of interior gypsum board until space is enclosed, space is not exposed to other sources of water, and space is free of standing water.

B. Maintain areas receiving gypsum board at minimum 50-degree F for 48 hours prior to application and continuously after application until drying of joint compound is complete; comply with ASTM C840.

C. Immediately remove from site gypsum board for interior use exposed to water, including gypsum board with water stains, with signs of mold, and gypsum board with mildew.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. United States Gypsum Co., USG Corp.

B. Georgia-Pacific Corp.

C. National Gypsum Co.

D. PABCO

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide gypsum board assemblies including gypsum board, joint treatment, acoustic accessories, and general accessories.

1. Systems Responsibility: Provide products manufactured by or recommended by manufacturer of gypsum board to maintain single-source responsibility for system.

B. Performance Requirements: Perform gypsum board systems work in accordance with recommendations of ASTM C840 unless otherwise specified.

C. Gypsum Board: Comply with ASTM C840; maximum permissible lengths; square ends, tapered edges on boards to be finished.

1. Mold Resistant Gypsum Board: ASTM D3273; provide at high humidity areas not covered with tile including but not limited to kitchens, restrooms, plumbing walls.

a. Manufacturers:

1) USG/Sheetrock Mold Tough Firecode Core.
2) Georgia Pacific/ToughRock Mold-Guard Fireguard X.
3) National Gypsum/Gold Bond XP Fire-Shield Gypsum Board.
4) Substitutions: Refer to Section 01 25 00.

2. Tile Substrates: Cementitious backer units specified in Section 09 30 00 - Tiling.

3. Cementitious Backer Units for Fiberglass Wall Panels and Paneled Shower/Tub Surrounds: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; approximately 1/2" thick; UL rated for fire rated assemblies.

a. Manufacturers:

1) USG Industries, Durabond Division/Durock.
2) National Gypsum Co./PermaBase Cement Board.
3) Custom Building Products/Wonderboard.
4) James Hardie Building Products/Hardibacker.
5) Substitutions: Refer to Section 01 25 00.

b. Contractor Option Coated Glass Mat Backer Units: Georgia Pacific/DenShield, UL fire rated as required to maintain integrity of fire rated assemblies.

4. Glass Mat Sheathing: Silicone treated glass mat gypsum sheathing, ASTM C1177, Type X, 5/8” thick unless otherwise indicated.

a. Manufacturers:

1) USG/Securock Glass Mat Sheathing Firecode X.
2) Georgia Pacific/DensGlass Gold Fireguard Type X.
3) National Gypsum/Gold Bond Brand eXP Fire-Shield Sheathing.
4) Substitutions: Refer to Section 01 25 00.
5)

5. Exterior Gypsum Soffit Board: ASTM C931, Type X; as recommended by manufacturer for exterior non-exposed applications.

6. Extended Exposure Gypsum Board: Fire rated Type X gypsum board designed specifically for extended exposure to moisture during construction; ASTM C1177; provide with score of 10 when tested using ASTM D3273 for mold resistance.

a. Manufacturers:

1) USG/Sheetrock Fiberock Aqua Tough Sheathing.
2) Georgia Pacific/DensArmor Plus or DensGlass.
3) National Gypsum/eXP Extended Exposure Sheathing.
4) Substitutions: Refer to Section 01 25 00.

D. Gypsum Board Accessories: Comply with ASTM C840.

1. Provide protective coated steel corner beads and edge trim; type designed to be concealed in finished construction by tape and joint compound.

2. Corner Beads: Manufacturer's standard metal beads.

3. Edge Trim: “J”, "L", "LK", or "LC" casing beads.

4. Reinforcing Tape, Joint Compound, Adhesive, Water, Fasteners: Types recommended by system manufacturer and conforming to ASTM C475.

a. Typical Joint Compound: Chemical hardening type for bedding and filling, ready-mixed or powder vinyl type for topping.

5. Control Joints: Back-to-back casing beads.

a. Back control joints with 4 mil thick polyethylene air seal.

6. Reveals: Extruded aluminum special trim pieces in manufacturer's standard or custom shapes to conform to configurations and dimensions indicated.

   a. Manufactures:

      1) Fry Reglet Corp./Drywall Moldings.
      2) Gordon Inc./Final Forms I Drywall Trims.
      3) Substitutions: Refer to Section 01 25 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Gypsum Board Installation: Install in accordance with ASTM C840 and manufacturer's recommendations.

1. Use screws when fastening gypsum board to furring and to framing.

2. Erect gypsum board with ends and edges occurring over firm bearing.

   a. Ensure joints of second layer do not occur over joints of first layer in double layer applications.

3. For fire rated systems comply with requirements for fire ratings.

4. Place control joints to be consistent with lines of building spaces and as directed by Architect.

   a. Provide where system abuts structural elements.
   b. Provide at dissimilar materials.
   c. Lengths exceeding 30'-0" in partitions.
   d. Ceiling areas exceeding 50'-0" or 2500 square feet.
   e. Wings of "L", "U" and "T" shaped ceilings.

5. Place corner beads at external corners; use longest practical lengths.

6. Place edge trim where gypsum board abuts dissimilar materials.

7. Tape, fill, and sand exposed joints, edges, corners and openings to produce surface ready to receive finishes; feather coats onto adjoining surfaces.

8. Finishing: Comply with Gypsum Association (GA) “Levels of Gypsum Board Finish”.

   a. GA Level 4 (Typical): Provide three-coat finishing and sanding is required for surfaces indicated to be painted; provide flush, smooth joints and surfaces ready for applied paint finishes.

9. Remove and replace defective work.

END OF SECTION

SECTION 09 30 00

TILING

ART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide tile installations with accessories, as required for complete installation.

1. Provide waterproofing membrane integral with tile setting beds.
2. Provide cementitious backer unit tile substrate.

B. Related Sections:

1. Section 09 21 00: Metal framing and gypsum board.
2. Section 09 30 90: Exterior large format tiling.

1.2 REFERENCES

A. ANSI A108.1: Installation of Tile with Portland Cement Mortar.

B. ANSI A108.5: Installation of Tile with Latex-Portland Cement Mortar.

C. ANSI A108.6: Installation of Tile with Chemical Resistant Water Cleanable Tile Setting and Grouting Epoxy.

D. ANSI A108.10: Installation of Grout in Tilework.

E. ANSI A108.11: Interior Installation of Cementitious Backer Units.

F. Tile Council of North America (TCNA): Handbook for Ceramic Tile Installation.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination, Large Format Tile and Framing: Tile Council of North America (TCNA) requires framing at large format tile to be maximum 16” on center and for maximum deflection of L/720 where large format tile as defined by TCNA is indicated.

1. Coordinate with framing installation to ensure proper stud spacing and deflection limits are provided at locations where large format tile is indicated.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of material for Project.

B. Samples: Furnish each type of tile clearly indicating pattern, coloration, and joints.

1. Color Charts: Submit actual tile sections showing full range of colors, textures, and patterns available for each type of tile.

2. Prepare two 12" square sample panels of each selected type of tile and grout.

1.5 SITE CONDITIONS

A. Provide heat and ventilation in areas where ceramic tile work is being performed, to allow tile to properly set.

B. Take precautionary measures necessary to ensure excessive temperature changes do not occur.

1.6 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist water penetration except where failure is result of structural failure of building. Repair system and pay for or replace damaged materials and surfaces.

1. Hairline cracking due to temperature or shrinkage is not structural failure.

2. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide tile installations with tile, grout, setting materials, and accessories as indicated.

B. Regulatory Requirements, General:

1. Interior Adhered Veneer: Comply with applicable California Code requirements for interior adhered veneer; maximum 20-psf.

2. Exterior Adhered Porcelain Veneer: Comply with applicable California Code requirements for exterior adhered veneer; maximum 9-psf, 5/8” thick, 24” in any face dimension, nor more than 3-sf in total face area.

C. Regulatory Requirements, Slip-Resistance: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and access for persons with disabilities.

D. Tile: Types as indicated which could include ceramic, ceramic mosaic, quarry, paver, porcelain, stone, and glass type tiles.

1. Manufacturers:

a. Dal-Tile Corp.
b. Crossville Tile.
c. Summitville Tiles, Inc.
d. Manufacturers listed on Finish Schedule.
e. Substitutions: Refer to Section 01 25 00.

2. Color, Style, and Pattern: As indicated on Finish Schedule, as selected by Architect from manufacturer’s full range of types of tiles indicated where not otherwise indicated.

a. Match Architect approved samples.

3. Base and Trim: Provide matching trim pieces, coordinated with sizes and coursing of adjoining flat tile as directed by Architect; types as indicated, as selected by Architect where not indicated.

E. Portland Cement Setting Bed: Portland cement bed conforming to ANSI A108.1 and TCNA recommendations including separator sheet and reinforcing mesh.

1. Where over waterproof membrane, separator sheet may be deleted.

2. Where over waterproof membrane or shower pan, separator sheet may be deleted.

F. Latex Thin Set: Thinset bond coat, consisting of latex-cementitious mortar conforming to ANSI A118.4.

1. Manufacturers:

a. Laticrete International Inc.
b. Bostik Construction Products/Hydroment.
c. Custom Building Products.
d. Mapei Corp.
e. Merkrete.
f. Substitutions: Refer to Section 01 25 00.

G. Latex-Cement Grout: ANSI A118.7, latex-cementitious type, uniform in color, resistant to shrinkage.

1. Manufacturers:

a. Laticrete International Inc.
b. Bostik Construction Products/Hydroment.
c. Custom Building Products.
d. Mapei Corp.
e. Merkrete.
f. Substitutions: Refer to Section 01 25 00.

2. Color: Match tile unless otherwise indicated.

H. Cementitious Backer Units: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; approximately 1/2" thick; UL fire rated as required to maintain integrity of fire rated assemblies.

1. Manufacturers:

a. USG Industries, Durabond Division/Durock.
b. National Gypsum Co./PermaBase Cement Board.
c. Substitutions: Refer to Section 01 25 00.

2. Contractor Option Coated Glass Mat Backer Units: Georgia Pacific/DenShield, UL fire rated as required to maintain integrity of fire rated assemblies.

I. Cleaning and Sealing Materials: As recommended by tile and grout manufacturers but not less than following.

1. Manufactures:

a. Laticrete International Inc./Stonetech.
b. Bostik Construction Products/Hydroment CeramaSeal.
c. Substitutions: Refer to Section 01 25 00.

J. Accessories: Provide as indicated and as required for complete tile installation for applications indicated.

1. Special Tile Trim Pieces: Provide as indicated on Drawings.

a. Manufacturers:

1) Schluter Systems L.P.
2) Blanke Corp.
3) Ceramic Tool Company, Inc.
4) Substitutions: Refer to Section 01 25 00.

2.1 MIXES

A. Mix and proportion cementitious materials for site-made leveling coats, setting beds and grout as recommended by the TCNA Handbook for Ceramic Tile Installation.

B. Mix and proportion pre-mixed setting beds and grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installing tile, ensure surfaces are level; comply with TCNA and tile manufacturer recommendations but not greater than following.

1. Bed Set Tile Tolerance: Maximum surface variation of 1/4" in 10'-0".

2. Thin Set Tile Tolerance: Maximum surface variation of 1/8" in 10'-0".

B. Ensure surfaces are clean and well cured.

1. Drains: Where indicated, ensure surfaces are properly sloped to drains.

C. Do not commence work until surface conditions are within tolerances required for proper installation; apply latex leveling material where necessary to meet required tolerances.

D. Waterproof and Crack Isolation Membrane: Install waterproof membrane at tile areas located above grade, in accordance with manufacturer's recommendations; extend membrane minimum 6" up walls.

1. Comply with waterproof membrane manufacturer recommendations for installation of tile over waterproof membrane.

E. Acoustic (Sound Deadening) Underlayment: Install acoustic underlayment system where indicated in accordance with manufacturer's recommendations and installation instructions to achieve maximum possible IIC and STC ratings.

1. Comply with manufacturer recommendations for installation of tile over acoustic underlayment system.

F. Backer Units: Install units in accordance with ANSI A108.11, manufacturer's recommendations, and as required to provide fire ratings indicated on Drawings.

G. Floor Sealer: Apply vapor retarding floor sealer on concrete floors indicated to receive epoxy set tile in accordance with manufacturer recommendations and installation instructions.

3.2 INSTALLATION

A. Install tile in accordance with manufacturer recommendations and installation instructions, referenced ANSI Standards, and TCNA recommendations for type of substrate and indicated setting method.

1. Complexity of TCNA variations in types of tile installation systems and potential for changes to surrounding conditions during design and construction makes exact listing of potential conditions improbable.

2. Contractor, installers, and manufacturer representatives shall inform Architect where actual conditions are not covered and where providing similar materials and systems do not comply with TCNA or manufacturer recommendations.

a. Where specified or similar materials and systems do not comply with TCNA or manufacturer recommendations submit proposed substitutions along with statement substitutions are of comparable quality to specified materials.

B. Following systems shall form the basis of tile installation systems required for Project. Where SITE CONDITIONS vary from TCNA and manufacturer recommendations, notify Architect immediately. Where different use similar materials and systems as appropriate.

1. Latex-Cement Thin Set Floors over Concrete: TCNA F113.

2. Latex-Cement Thin Set Floors over Waterproof and Crack Isolation Membrane: TCNA F122.

3. Latex-Cement Thin Set Floors over Acoustic Underlayment: TCNA F122.

4. Latex-Cement Thin Set Floors over Cementitious Backer Unit over Wood: TCNA F144.

5. Latex-Cement Thin Set Wall Tile over Cementitious Backer Units: TCNA W244.

6. Latex-Cement Thin Set Wall Tile over Coated Glass Mat Backer Units: TCNA W245.

C. Place tile in accordance with patterns indicated on Drawings or as directed by Architect; carefully plan tile layouts, ensure pattern is uninterrupted from one surface to the next and through doorways.

1. Apply latex thin set to back of tile where necessary to ensure 100% bond between bond coat and substrate; replace tiles which break due to voids between tile and substrate.

D. Place stone thresholds level and true to line; in correct alignment with tile, doors, and partitions.

E. Neatly cut tile around fixtures and drains; accurately form corners, base, intersections and returns.

1. Base, Coves: Flush cove type with base grout joint on wall, cove tile on floor, unless otherwise indicated.

2. Corners and Edges: Bullnose tile unless otherwise indicated.

F. Locate expansion joints, control joints, contraction joints, and isolation joints where indicated; where not indicated, provide as recommended by TCNA Handbook and as approved by Architect.

1. Install special trim pieces as indicated on Drawings and in accordance with manufacturer recommendations and installation instructions, true to lines and levels indicated and in correct relationship with tile and adjacent materials.

G. Ensure tile joints are uniform in width, subject to normal variance in tolerance allowed in tile size; ensure joints are watertight, without voids, cracks, excess mortar, or grout.

H. Sound tile after setting, remove and replace hollow sounding units.

I. Allow tile to set for a minimum 48 hours prior to grouting.

J. Grout tile to comply with recommendations of TCNA and as specified.

K. Leave completed installation free of broken, damaged, and faulty tile.

3.2 CLEANING AND SEALING

A. Clean tile surfaces free of foreign matter upon completion of grouting.

B. Seal tile and grout surfaces when recommended by manufacturer for materials and applications involved; comply with manufacturer's recommendations.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.

1. Specified surface preparation, priming and coats of paint are in addition to shop-priming and surface treatment specified under other sections of work.

2. Painting and finishing include field finishing of exterior and interior items not listed as "Surfaces not to be Painted" unless clearly indicated otherwise.

3. Painting and finishing include field finishing of select shop finished items such as mechanical grilles and registers and shop primed items such as access panels and louvers in doors, to match adjacent surfaces.

    a. Match adjacent surfaces in color and sheen unless otherwise indicated.

4. Field paint exposed bare and covered pipes, ducts, and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work in occupied spaces.

B. Surfaces Not to be Painted:

1. Finished items including finished metal surfaces.
2. Walls and ceilings in concealed areas and generally inaccessible areas.
3. Moving parts of operating mechanical and electrical units.
4. Labels: Keep equipment identification and fire rating labels free of paint.
5. Plastic smoke stops and weather-stripping at doors.

C. Related Sections: Shop priming of ferrous metal items is included under various Specification sections.
1. Section 09 67 20: Decorative epoxy coating.
2. Section 09 96 70: High performance coating for exterior steel.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical information, including paint label analysis and application instructions for each material.

B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.

1. Brush-Outs: Submit samples of each color and material with texture to simulate actual conditions, on hardboard.

a. Submit 8" by 10" samples of wood finishes on actual wood surfaces; label and identify each as to location and application.

b. Submit samples of concrete masonry (maximum 4" square) defining filler, prime and finish coats.

2. Field Samples: Duplicate painted finishes of approved samples on actual wall surfaces and components for approval prior to commencing work.

a. Size: Minimum 100 sf located where approved.
b. Components: One full component as directed.
c. Simulate finished lighting conditions for review.

C. Manufacturer Certificates: Furnish certificates from each manufacturer stating materials are top quality lines and suitable for intended use on this Project.

1. *CAL*Green: Submit additional information as necessary to verify compliance with *CAL*Green requirements.

2. *CAL*Green Requirements: Refer to Section 01 35 15 – *CAL*Green Environmental Requirements and comply with applicable *CAL*Green Checklist indicating requirements applicable to Project.

a. Comply with *CAL*Green requirements including those relative to finish material pollution control for paints and coatings.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, with:

1. Name of material, color and sheen.
2. Manufacturer's name, stock number and date of manufacture.
3. Contents by volume, for major pigment and vehicle constituents.
4. Thinning and application instructions.

1.4 SITE CONDITIONS

A. Apply water-base paints when temperature of surfaces and surrounding air are between 50 and 90-degrees F.

B. Do not apply paint in rain, fog or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces.

C. Painting may be continued during inclement weather if areas to be painted are enclosed and heated within temperature limits specified.

D. Provide additional temporary ventilation during interior application of paints to eliminate volatile organic compound (VOC) emissions from interior spaces as quickly as possible.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Benjamin Moore & Co.

B. Sherwin-Williams Co.

C. Pittsburgh Paints, PPG Pittsburgh Paints, including Glidden Professional.

D. Dunn-Edwards Corp.

E. Vista Paint Co.

F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.

1. Definition: "Painting" and “coating” as used herein means systems including primers, emulsions, enamels, stains, sealers and fillers, whether used as prime, intermediate or finish coats.

B. Regulatory Requirements:

1. Volatile Organic Compound (VOC) Emissions: Furnish materials approved for use by applicable air quality management district for limitations of volatile organic compounds for architectural or special coatings as applicable.

2. California Stair Stripes: Paint 2" stripes at stair nosing not otherwise marked, full tread and landing width, in accordance with California Code of Regulations, Title 24, Access Compliance requirements.

a. Exterior Stairs: Provide at landing and each tread in each stair run.
b. Interior Stairs: Provide at landing and last tread at each stair run.

C. Material Quality: Provide top line quality commercial grade (professional painter) paints; materials not bearing manufacturer's identification as their top line product shall not be acceptable.

1. Primers: Provide premium grade primers recommended by paint manufacturer for substrates indicated and for finish systems specified.

2. Undercoats and Barrier Coats: Provide undercoat paints produced by same manufacturer as finish coats; use only thinners approved by paint manufacturer and use only within recommended limits.

3. Finish Coats: Provide finish coats capable of being washed with mild detergent without loss of color, sheen, or pigments.

    a. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.

4. Finish Coat Coordination: Provide finish coats which are compatible with prime paints, undercoats, and barrier coats used.

    a. Review other Specification sections in which prime paints are provided; ensure compatibility of total coatings systems.

    b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.

    c. Provide barrier coats over incompatible primers or remove and prime as required.

    d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.

D. Colors and Finishes: Prior to commencement of painting work, Architect will furnish color chips for surfaces to be painted.

1. Use of proprietary names in color selection is not intended to imply exclusion of equivalent products of other manufacturers.

2. Final acceptance of colors will be from samples applied on site.

3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Examine areas and conditions under which painting work is to be applied.

1. Start of painting work indicates acceptance of surfaces and conditions of surfaces and conditions within any area.

2. Where exposed items or surfaces are not specifically mentioned in Schedules, paint same as adjacent similar materials or areas.

3. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable paint film.

B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.

1. Existing Painted Finishes:

a. Clean existing painted surfaces and remove oil, grease, dust, stains, scale, efflorescence, mildew, mold, algae, blisters, and non-adhering paint.

b. Measure adhesion of existing paints using ASTM D3359 tape test; remove existing coatings where poor adhesion is indicated.

c. Feather edges of severely deteriorated paint where several coats are removed as part of cleaning, to provide smooth transition for new paint.

d. Fill holes, cracks, and defects and fill and sand smooth, ready for new paint finish.

C. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting; after painting reinstall removed items.

D. Clean surfaces before applying paint; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.

E. Cementitious Materials: Prepare by removing efflorescence, chalk, dirt, grease, oils, and by roughening as required to remove glaze.

1. Determine alkalinity and moisture content of surfaces to be painted.

2. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, neutralize before application of paint.

3. Do not paint over surfaces where moisture content exceeds manufacturer's printed directions.

F. Wood: Clean wood surfaces of dirt, oil, and other foreign substances; sandpaper smooth surfaces exposed to view and dust off.

1. Scrape and clean seasoned knots and apply thin coat of recommended knot sealer, before application of priming coat.

2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job; prime edges, ends, faces, undersides, and backsides of wood.

3. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler; sandpaper smooth when dry.

G. Ferrous Metals: Touch up shop-applied prime coats wherever damaged using same type of primer as applied in shop or barrier coat compatible with finish paint.

1. Bare Surfaces: Clean surfaces that are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum-based solvent; primer and touch-up primer to be zinc-rich primer.

H. Mix painting materials in accordance with manufacturer's directions.

I. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

J. Stir materials before application to produce mixture of uniform density and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

3.2 APPLICATION

A. Apply paint in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and type of material being applied.

1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color and appearance.

2. Provide extra attention during application to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.

3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces; paint surfaces behind permanently fixed equipment and furniture with prime coat only.

4. Finish doors on tops, bottoms and side edges same as faces.

5. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

6. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

7. Sand lightly between coats when recommended by system manufacturer.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated or prepared for painting as soon as practicable after preparation.

1. Allow time between successive coatings to permit proper drying.

2. Do not recoat until paint feels firm and does not deform or feel sticky under moderate thumb pressure.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.

D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.

E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections.

1. Opaque Finishes: Provide opaque, uniform finish, color and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness, and other surface imperfections are not acceptable.

2. Transparent and Stained Finishes: Produce glass smooth surface film of even luster; provide with no cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, and other surface imperfections.

F. Completed Work: Match approved samples for color, texture and coverage; remove, refinish or repaint work not accepted.

3.3 PAINTING SCHEDULE

A. Exterior Work: Provide following paint systems and sheens unless otherwise indicated.

1. Metal: Semigloss sheen.

a. 1st Coat: Touch-up primer, prime if none.
Ferrous Metal Spot Prime: Dunn Edwards, BLOC-RUST Premium, Rust-Preventative Metal Primer (BRPR00 Series),
or
Ferrous Metal Full Prime, Dunn Edwards, ENDURAPRIME™ Acrylic Rust Preventative Metal Primer (ENPR00).
or
Galvanized Metal: Dunn Edwards, Enduraprime Galvanized Metal Primer ~~(ULGM00)~~ (ENGM00)

b. 2nd and 3rd Coat: Exterior 100% acrylic enamel.
Dunn Edwards, ENDURA-COAT® Interior/Exterior Semi-Gloss Industrial Maintenance Coating (ENCT50)

2. Metal: High-performance coating specified in Section 09 96 70.

3. Concrete: Flat sheen.

a. 1st Coat Primer: Dunn Edwards, EFF-STOP Premium, Masonry Primer/Sealer (ESPR00)

b. 2nd and 3rd Coat: Exterior acrylic latex emulsion.
Dunn Edwards, EVERSHIELD, Ultra-Premium Exterior Flat Paint (EVSH10),
or
SPARTASHIELD, Premium Exterior 100% Acrylic Flat Paint (SSHL10)

4. Concrete Masonry Units: Flat sheen.

a. Refer to Section 09 96 80 – Elastomeric Coating.

B. Interior Work: Provide following paint systems and sheens unless otherwise indicated.

1. Gypsum Board Systems: Eggshell (satin) sheen at walls, flat sheen at ceilings, semigloss sheen at toilet rooms.

    a. 1st Coat: Universal primer.
    Dunn Edwards, ULTRA-GRIP Premium, Acrylic Multi Purpose Primer (UGPR00 Series)
    b. 2nd and 3rd Coat: Interior latex or acrylic latex emulsion.
    Flat:
    Dunn Edwards, SUPREMA, Ultra-Premium Interior Flat Paint (SPMA10),
    or
    SPARTAZERO, Premium Zero VOC Flat (SZRO10)
    Eggshell:
    Dunn Edwards, SUPREMA, Ultra-Premium Interior Eggshell Paint (SPMA30),
    or
    SPARTAWALL, Premium Zero VOC Interior Eggshell Paint (SWLL30)
    Semi-Gloss:
    Dunn Edwards, SUPREMA, Ultra-Premium Interior Semi-Gloss Paint (SPMA50),
    or
    SPARTAWALL, Premium Zero VOC Interior Semi-Gloss Paint (SWLL50)

2. Metal: Semigloss sheen.

    a. 1st Coat: Touch-up primer, prime if none.
    Ferrous Metal Spot Prime: Dunn Edwards, BLOC-RUST Premium, Rust-Preventative Metal Primer (BRPR00 Series),
    or
    Ferrous Metal Full Prime: Dunn Edwards, ENDURAPRIME™ Acrylic Rust Preventative Metal Primer (ENPR00).
    Or
    Galvanized Metal: Dunn Edwards, Enduraprime Galvanized Metal Primer ~~(ULGM00)~~ ENGM00
    b. 2nd and 3rd Coat: 100% acrylic enamel.
    Dunn Edwards, ENDURA-COAT® Interior/Exterior Semi-Gloss Industrial Maintenance Coating (ENCT50)

3. Concrete Masonry Units: Flat sheen.

    a. 1st Coat: Surface filler.
    Dunn Edwards, Smooth BLOCFIL Premium, Interior/Exterior Concrete Block Filler (SBPR00)
    b. 2nd and 3rd Coat: Interior latex emulsion.
    Dunn Edwards, SUPREMA, Ultra-Premium Interior Flat Paint (SPMA10)
    Or
    SPARTAZERO, Premium Zero VOC Flat (SZRO10)
    c. Apply filler at rate to ensure coverage with pores filled.
    Semi-Gloss:
    Dunn Edwards, SUPREMA, Ultra-Premium Interior Semi-Gloss Paint (SPMA50),
    or
    SPARTAWALL, Premium Zero VOC Interior Semi-Gloss Paint (SWLL50)

C. Sheens: Comply with ASTM D523, reflectance of paint.

1. Flat: 1-10.
1. Satin: 15-30.
2. Eggshell: 30-45.
3. Semigloss: 45-75.
4. Gloss: 75-100.

3.2 CLEAN-UP, PROTECTION, AND REPAIR

A. Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans and rags from site at end of each workday.

1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

1. Provide "Wet Paint" signs to protect newly painted finishes.

2. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced painted surfaces.

END OF SECTION

SECTION 09 96 20

GRAFFITI RESISTANT COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide non-sacrificial graffiti resistant coatings suitable for applications to surfaces indicated to receive graffiti resistant coating.

B. Related Sections:

1. Section 09 90 00: Paints and coatings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate graffiti resistant coating with surfaces upon which coating is to be applied to ensure coating does not change appearance of surface and does not detrimentally impact surface.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

B. Samples: Furnish samples of graffiti resistant coating applied to each type of surface required for Project.

C. Manufacturer Certification: Submit certification by manufacturer materials supplied comply with applicable codes and Contract Documents and are compatible with substrates indicated to receive graffiti resistant coating.

D. Maintenance Instructions: Furnish manufacturer recommendations for cleaning of graffiti and other substances from system; note specific methods for determining type of material used for graffiti (marker, spray, etc.) and cleaning methods for each.

E. Maintenance Materials: Furnish supply of each type of cleaning material required for standard graffiti types clearly labeled regarding cleaning material type and specific applications relating to types of graffiti material cleans.

1.4 QUALITY ASSURANCE

A. Field Sample: Apply minimum 50 sf of graffiti resistant coating where directed by Architect; sample installation establishes minimum workmanship standard. Approved field sample may be incorporated into Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufacturer recommendations in dry, ventilated, protected area with minimum temperature of 45 degrees F. and away from fires or open flames.

1.6 SITE CONDITIONS

A. Maintain minimum surface and ambient temperature of 45 degrees F. for 24 hours before, during and 24 hours after application, or until wall coating has cured.

B. Ventilate area in which coating is being applied.

C. Comply with graffiti coating manufacturer recommendations for maximum allowable moisture content of surfaces to receive coating; surfaces to have negative alkalinity.

1.7 MAINTENANCE

A. Extra Stock: Provide minimum two full cases containing twelve 16 oz bottles of each chemical necessary to remove graffiti from coating in factory sealed containers labeled regarding manufacturer, type, and locations applied in Project.

1. Deliver and store where directed by Owner prior to Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Rainguard Brands LLC/Vandl Guard.

B. Prosoco Inc./Sure-Klean Graffiti Barrier NS.

C. Monopole, Inc./Permashield.

D. Sherwin-Williams/Anti-Graffiti Coating.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide non-sacrificial graffiti resistant coatings suitable for applications to surfaces indicated to receive graffiti resistant coating.

B. Regulatory Requirements, VOC: Coating to comply with applicable air quality management district limitations on volatile organic compound (VOC) emissions for architectural or special coating as applicable.

C. Performance Criteria:

1. System shall not require reapplication regardless of number of graffiti taggings during 10-year period after application.

2. Coating shall show no signs of deterioration or change of appearance after graffiti removal during 10-year period after application including no ghost staining and no shadowing.

3. Cleaning chemicals shall be capable of removing 100% of all types of paint and graffiti materials from treated surfaces without damaging coating or substrate.

4. Coating shall not increase dirt pick-up of substrate.

D. Non-Sacrificial Graffiti Resistant Coating: Provide non-sacrificial antigraffiti coating system compatible with surfaces indicated to receive graffiti resistant coating and that does not change appearance of substrate when coating is dry.

1. Coating to be water clear, non-yellowing, free of waxes and urethane.

2. Chemical Resistance: Coating shall be tested for following chemicals; list is not intended to be exclusionary regarding coating ability to resist graffiti.

a. MEK: No effect after five days.
b. Carboxylic Acid: No effect after five days.
c. 75% Phosphoric Acid: No effect after five days.
d. 37% HCL: 3 hours blister.
e. 50% Sulfuric Acid: No effect after five days.
f. 20% NIT: 68 hours blister.

3. Undercoating: Provide undercoating over porous surfaces where recommended by system manufacturer.

4. Cleaning Materials: Non-caustic, biodegradable, and recyclable, allowing graffiti removal without use of blasting equipment, hot water, or high-pressure wash equipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare surfaces in accordance with manufacturer's recommendations.

B. Mask and protect surfaces, finishes and materials not receiving coating to provide true juncture lines and protect from overspray or damage.

C. Remove and store finish hardware, fixture covers and accessories. Replace after coating has cured.

D. Report defects of surfaces which could affect application of coating.

E. Other painting and finishing shall be completed prior to application.

F. Keep unauthorized traffic out of area in which coating is being applied.

3.2 INSTALLATION

A. Apply coatings in accordance with manufacturer's recommendations and application instructions for each type of substrate receiving coating, by trained applicators.

3.3 CLEANING

A. As work proceeds, clean up overspray and spatter, excess materials and rubbish.

B. Upon completion, and after coating has cured, clean and replace finish hardware, fixtures and fittings previously removed.

C. Repair adjacent surfaces damaged by application of graffiti resistant coating.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide general signage as indicated complete with attachment devices and accessories as required for complete installation.

B. Related Sections:

1. Section 09 90 00: Traffic line paint.
2. Section 10 44 00: Fire extinguisher cabinet graphics.
3. Division 26: Photoluminescent exit signs.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature and indicate each sign type, style, color, and method of attachment.

B. Shop Drawings: Furnish listing of sign types, lettering, and locations, along with dimensions of each sign.

1. Computerized Output: Furnish computerized samples of signs and graphics at full scale duplicating final appearance.

2. Dimensional Letter Signs: Furnish complete shop drawings regarding fabrication and method of attachment of dimension letter signs.

3. Photoluminescent Egress Path Signage: Submit complete shop drawings indicating locations of luminous egress path markings and signage.

C. Samples: Furnish full size samples where requested.

D. Certification: Furnish manufacturer certification that photoluminescent egress path markings and signage conform to Building Code requirements.

1.3 QUALITY ASSURANCE

A. relative to finish material pollution control for adhesives.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Package separately or in like groups of names, labeled as to names enclosed; include installation template, attachment system and installation instructions.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. ASI Sign Systems, Inc. (773.550.5535).

B. Best Signs (800.235.2378).

C. Clarke Systems (800.331.1891).

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide signage as indicated with attachment devices and accessories.

B. Regulatory Requirements: Provide signs for assuring access for persons with disabilities in accordance with state and federal regulations.

1. California Regulations: Comply with California Building Code.

2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.

C. Dimensional Letter Signage: Provide individual letter signs as indicated.

1. Aluminum: Manufacturer's standard for individual letter signs.

a. Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.

2. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.

3. Fabrication: Fabricate dimensional letters as indicated, of minimum 0.25" plate or casting with edges and corners smooth and finished to match adjacent metal finishes.

4. Attachment: Secure letters using connections concealed after installation; method subject to Architect approval.

a. Take care back welding does not damage exposed sign surfaces.

D. Toilet Room Door Signs: Provide door signs conforming to California requirements for signs for toilet rooms; concealed mounting system.

1. Material, Plastic: Manufacturer’s standard colored plastic/photopolymer signs; color as indicated, as selected by Architect from manufacturer’s full range of colors where not otherwise indicated.

a. Texture: Smooth.

2. Material:

    a. Aluminum: Manufacturer's standard for individual letter signs.

        1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.

    b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.

3. Provide signs required by California Code of Regulations Title 24.

    a. Mens /Boys Room: 12" equilateral triangle, vertex pointing up, 0.25” thick.

    b. Womens /Girls Room: 12" diameter circle, 0.25” thick.

    c. Gender Neutral Room: 12" diameter circle with equilateral triangle, vertex pointing up, superimposed on the circle; circle and triangle each 0.25" thick.

        1) Color of triangle shall contrast with color of circle which shall contrast with color of door face.

4. Colors: As selected to contrast with doors finish color

5. Symbols: As selected from manufacturer's standard symbols.

6. Adhesive: Type as recommended by sign manufacturer for type of substrate involved.

E. Toilet Room Wall Signs: Provide signs conforming to California Building Code and ADA Standards for signs for permanent rooms, with inset symbols and with raised and Braille characters; concealed mounting system.

1. Material, Plastic: Manufacturer’s standard colored plastic/photopolymer signs; color as indicated, as selected by Architect from manufacturer’s full range of colors where not otherwise indicated.

    a. Texture: Smooth.

2. Material:

    a. Aluminum: Manufacturer's standard for individual letter signs.

        1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.

    b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.

3. Comply with California Building Code and ADA Standards for raised and Braille characters, pictorial symbols, finish, and contrasts requirements.

F. Accessible Entry Decals: Provide minimum 6" square decals with international handicapped symbol white on blue background with white border, applied to glass at accessible entry doors of existing buildings where all entry doors are not accessible.

1. Accessible Entry Direction Signs: Provide signs conforming to California and ADA Standards for permanent signs.

    a. Provide aluminum signs with vinyl reflective coating and with text and symbols meeting requirements of California Building Standards Code and with ADA Standards.

    b. Mounting: Wall mount or provide 3” diameter galvanized Schedule 40 steel post set in 12” diameter by 36” deep concrete footing unless otherwise indicated.

~~G. Stairway Signs: Provide colored plastic/photopolymer signs in stairways, conforming to California Building Standards Code, Section 1022.9.~~

~~1. Lettering: Type as required by CBC.~~

~~2. Colors, Size, and Style: Conform to referenced code requirements and as approved by Architect.~~

~~3. Information: Identify stairway, indicate whether there is roof access, floor level, and upper and lower terminus of stairway, and story of and direction to exit discharge.~~

~~4. Provide raised five-pointed star located to left of identifying floor level at exit discharge level.~~

~~5. Provide Floor Identification Signs required by CBC including both tactile and Braille sign.~~

~~6. Provide photoluminescent egress path marking and signs as required by California Building Code for high rise buildings and as specified for photoluminescent egress markings and signage.~~

H. Parking Signs: Provide aluminum signs with vinyl reflective coating and with text and symbols meeting requirements of California Building Standards Code and with ADA Standards.

1. At entry to parking provide state required sign indicating unauthorized vehicles parking in accessible parking spaces may be towed at owner's expense using exact wording required by CBC.

2. Verify location and telephone number of location vehicle is to be towed with Owner; place this information as permanent part of sign wording.

3. At parking spaces provide California required reflectorized sign, minimum 70 sq. inches, with symbol indicating accessibility.

4. At van accessible parking spaces provide required "VAN PARKING" signs.

5. Mounting: Wall mount or provide 3” diameter galvanized Schedule 40 steel post set in 12” diameter by 36” deep concrete footing unless otherwise indicated.

I. Tactile Exit Door Signs: Provide colored plastic/photopolymer signs, conforming to California Building Code Section 1013.4 and ADA Standards for signs for permanent rooms, with tactile raised and Braille characters; concealed mounting system.

1. Colors: As selected by Architect.

2. Size and Style: As indicated on Drawings.

J. Room Identification and Direction Signs: Provide signs conforming to California and ADA Standards for permanent signs, total thickness 0.125"; provide raised and Braille characters conforming to California and ADA Standards; concealed mounting.

1. Material, Plastic: Manufacturer’s standard colored plastic/photopolymer signs; color as indicated, as selected by Architect from manufacturer’s full range of colors where not otherwise indicated.

   a. Texture: Smooth.

2. Material:

   a. Aluminum: Manufacturer's standard for individual letter signs.

      1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.

   b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.

3. Sizes and Styles: As indicated on Drawings, as directed by Architect where not otherwise indicated.

K. Maximum Occupancy Signs: Provide signs conforming to requirements of authorities having jurisdiction, total thickness 0.125"; concealed mounting.

1. Material, Plastic: Manufacturer’s standard colored plastic/photopolymer signs; color as indicated, as selected by Architect from manufacturer’s full range of colors where not otherwise indicated.

   a. Texture: Smooth.

2. Material:

   a. Aluminum: Manufacturer's standard for individual letter signs.

      1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.

   b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.

3. Sizes and Styles: As indicated on Drawings, as directed by Architect where not otherwise indicated.

L. Applied Copy Signs and Graphics: Letters and graphics as indicated on Drawings; Contractor option of silk-screen or vinyl applied.

1. Silk-screen Signs and Graphics: Computer design screens for signs and graphics to designs and criteria established by Architect.

    a. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink; colors as selected by Architect.

2. Vinyl Signs and Graphics: Computer design vinyl signs and graphics to designs and criteria established by Architect.

    a. Vinyl: Opaque non-reflective vinyl film, minimum 0.0035" thick, with pressure sensitive adhesive backing suitable for applications indicated; match 3M/Scotchcal Vinyl Film.

M. Emergency Evacuation Signs: Silk-screened or photopolymer polycarbonate with graphics on back. Provide with tactile and Braille information conforming to California requirements and ADA Standards where required.

1. Information: Provide sign system with information as required by applicable authorities for emergency egress.

2. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink.

    a. Silk-Screen Colors: As selected by Architect.

3. Size and Style: As indicated on Drawings and acceptable to applicable authorities.

4. Attachment: Method subject to Architect approval.

N. Photoluminescent Egress Path Markings and Signage: Provide exit path marking and signage required by applicable codes including but not limited to exit path markings, stair nosing, handrails, demarcation and obstruction markings, doors, and hardware.

1. Acceptable Manufacturers:

    a. Balco Inc./IllumiTread Exit Path Markings.
    b. ZERO International/Exit Marking Systems.
    c. American Permalight Inc./Egress Path Markings.
    d. Active Safety/Egress Path Markings.
    e. Substitutions: Refer to Section 01 25 00.

2. Refer to CBC Title 24, Part 2, Section 1025.

3. System: UL 1994 listed.

4. Photoluminescent exit signs are in Division 26.

2.3 FABRICATION

A. Signs and Graphics:

1. Character Type: Characters on signs shall be raised 1/32” and shall be sans serif uppercase case characters accompanied by Grade 2 Braille.

2. Character Size: Raised characters shall be minimum 5/8” and maximum 2”.

3. Finish and Contrast: Contrast between character, symbols and their background shall be 70% minimum and have non-glare finish. See California Building Code Section 11B-703.5.1

4. Grade 2 Braille: California (contracted) Grade 2 Braille shall be used wherever Braille is required.

a. Dots shall be 1/10” on centers with 2/10” space between cells, measured from second column of dots in first cell to first column of dots in second cell.

b. Dots shall be raised minimum 1/.40” above background.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs in accordance with manufacturer recommendations and installation instructions, free from distortions and defects.

B. Dimensional Letter Signage: Locate dimensional letters with spacing based on full-size computer-generated installation drawings secured to structure as required to resist anticipated loads.

1. Final Location: As approved in field by Architect based on full size drawings.

C. Toilet Room Door Signs: Install signs on doors after doors are painted and finished.

1. Location: Mount signs with centerline of sign between 58" and 60" height as required by applicable code.

2. Install centered and level, in line, in accordance with the manufacturer's recommendations.

3. Clean and polish, remove excess adhesive.

D. Toilet Room Wall Signs: Install signs on walls after surfaces on which they are to be mounted are painted and finished.

1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.

2. Location: Mount signs with tactile characters 48" minimum (baseline of lowest Braille cells) and 60" maximum (baseline of highest line of raised characters)

above finished floor and with on strike side of door for room identification signs as required by applicable codes, at heights indicated on details.

3. Install level, in line, in accordance with California Building Code and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.

4. Clean and polish, remove excess adhesive.

E. Entry Signs: Install in locations as approved by Architect.

1. Accessible Entry Direction Signs: Provide mounting hardware, including painted posts, as needed; mount signs at heights required by state code.

2. Install signs at location as indicated, as directed by Architect and in compliance with applicable regulations where not indicated.

F. Stair Signs: Install signs inside stairwell after walls are finished, at locations immediately adjacent to door on strike side as required by referenced code, readily visible when door is open.

1. Location: Mount signs at 48" to 60" height as required by applicable codes.

G. Parking Signs: Provide mounting hardware, including painted posts, as needed; mount signs at heights required by state code.

1. Install parking entry sign at location as directed by Architect.

H. Tactile Exit Door Signs: Install at doors with lighted “EXIT” signs; apply after walls are finished.

1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.

2. Install level, in line, in accordance with the manufacturer's recommendations and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.

3. Clean and polish, remove excess adhesive.

I. Room Identification and Direction Signs: Install signs after walls are finished.

1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door for room identification signs, where indicated for direction signs.

2. Room Identification Signs Location: Mount signs with tactile characters 48" minimum (baseline of lowest Braille cells) and 60" maximum (baseline of highest line of raised characters) above finished floor and with on strike side of door for room identification signs and where indicated for directional signs.

3. Install signs level, in line, in accordance with the manufacturer's recommendations, California Building Code and ADA Standards.

4. Install room identification signs at doors to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.

5. Clean and polish, remove excess adhesive.

J. Maximum Occupancy Signs: Install signs after walls are finished.

1. Location: Mount signs at 48" to 60" height in location as approved by authorities having jurisdiction.

2. Install signs level, in line, in accordance with the manufacturer's recommendations.

3. Clean and polish, remove excess adhesive.

K. Applied Copy Signs and Graphics: Examine surfaces and construction for conditions adversely affecting installation, performance and quality of work.

1. Apply signage and graphics centered and level, in line, in accordance with manufacturer's recommendations.

L. Emergency Evacuation Signs: Install signs after walls are finished.

1. Location: Mount signs at locations indicated, as directed by Architect and applicable authorities if not otherwise indicated.

2. Install signs level and in accordance with the manufacturer's recommendations and requirements of applicable authorities.

3. Clean and polish.

M. Photoluminescent Egress Path Markings and Signage: Install exit path marking and signage as required by applicable codes.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide toilet accessories with attachment hardware and rough-in frames for complete operational installation.

B. Related Sections:

1. Section 10 21 00: Hardware for toilet partitions, including coat hook/bumper mounted on partition doors, and wall bumpers for out swinging doors.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data illustrating each accessory at large scale.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver inserts and rough-in frames to jobsite at appropriate time for building in.

B. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

C. Pack accessories individually, protect each item and its finish.

1.4 SITE CONDITIONS

A. Protect adjacent or adjoining finished surfaces from damage during installation of work of this section.

B. Before starting work notify Architect in writing of conditions detrimental to installation or operation of units.

C. Verify with Architect exact location of accessories.

1.5 WARRANTY

A. Extended Correction Period:

1. Replace mirrors which exhibit signs of desilvering or distortion.

2. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Bobrick Washroom Equipment, Inc.

B. Bradley Corporation.

C. American Specialties, Inc.

D. Manufacturers listed on Toilet Accessories Schedules.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide toilet accessories with attachment hardware and rough-in frames.

1. Provide standard materials and finishes for accessories listed; where more than one material or finish is available and not otherwise indicated provide as selected by Architect from manufacturer's standard materials and finishes.

B. Regulatory Requirements - Access for Persons with Disabilities: Comply with California Building Standards Code and Americans with Disabilities Act (ADA) Standards.

C. Stainless Steel Sheet: ASTM A666, commercial grade, Type 304, gages as standard with manufacturer of specified items.

D. Stainless Steel Tubing: ASTM A269, commercial grade, seamless welded.

E. Mirror Glass: ASTM C1036, q1 mirror select clear float glass with full silver coating, copper coating and organic coating; minimum 1/4" thick.

F. Sheet Steel: ASTM A1008, cold rolled stretcher leveled; minimum G90 galvanized coating, ASTM A924 and A653.

G. Adhesive: Epoxy type contact cement as recommended by accessory manufacturer; comply with applicable requirements for limitations on volatile organic compound (VOC) emissions.

H. Fasteners, Screws, and Bolts: Hot-dip galvanized; as recommended by accessory manufacturer for component and substrate.

I. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing and supply.

1. Provide minimum six keys to Owner representative.

2. Coin Operated Units: Provide locked coin box keyed separately from standard units, coin operated units keyed alike.

2.3 FABRICATION

A. Weld and grind smooth joints of fabricated components.

B. Form exposed surfaces of one sheet of stock, free of joints.

C. Fabricate units with tight seams and joints, exposed edges rolled; hang doors and access panels with continuous piano hinges; provide concealed anchorage where possible.

D. Provide steel anchor plates and anchor components for installation on building finishes.

E. Form surfaces flat without distortion; maintain flat surfaces without scratches and without dents; finish exposed edges eased, free of sharp edges where potential exists for physical contact.

F. Back paint components where in contact with building finishes, to prevent electrolysis.

G. Assemble components in shop; package complete with anchors and fittings.

2.4 FINISHES

A. Exposed Finishes: Stainless steel, number 4, satin finish; satin chrome finish acceptable where stainless steel not available for accessory item listed or scheduled.

B. Concealed Surfaces: Treat and clean, spray-apply one coat primer and baked enamel finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide templates and rough-in measurements.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's printed instructions using fasteners appropriate to substrate.

B. Install true, plumb, and level, securely and rigidly anchored to substrate.

C. Use tamper-proof, security type fasteners.

D. Adjust accessories for proper operation and verify they function properly.

E. Replace damaged and defective items.

F. Clean and polish exposed surfaces after removing temporary labels.

3.3 TOILET ACCESSORIES SCHEDULE

A. Refer to Drawings.

3.4 OTHER ACCESSORIES

A. Janitor Closet Mop Holders: Spring loaded anti-slip mop holders with rubber cam, with three mop holders on stainless steel.

1. Manufacturers:

a. Bobrick Washroom Equipment, Inc./Model B-223.
b. Bradley Corp./Model 9953.
c. American Specialties Inc./Model 0796A.

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide fire extinguisher cabinets with accessories as required for complete installation.

1. Semi-Recessed: Provide semi-recessed mounted fire extinguisher cabinets with exposed frame (trim); maximum 4” projection from finished wall surface.

2. Surface Mounted: Provide surface mounted fire extinguisher cabinets with exposed frame (trim) for areas not in a path of travel.

3. Fire Extinguishers: Furnish and install

B. Related Sections:

1. Division 21: Fire suppression systems.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. J.L. Industries.

B. Larsen’s Manufacturing Co.

C. Potter Roemer.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. Systems Description: Provide fire extinguisher cabinets with accessories.
1. Typical Areas: Semi-recessed exposed frame fire extinguisher cabinets.
2. Shear Walls, Exterior: Surface mounted exposed frame fire extinguisher cabinets.

3. secured access fire extinguisher cabinets panel with inside latch and lock.

B. Fire Extinguisher Cabinets with Exposed Frame (Trim): Provide semi-recessed mounting unless otherwise indicated, with maximum 4” extension from face of wall, provide trim suitable for installation indicated.

1. Type:

    a. J.L. Industries/Ambassador Series.
    b. Larsen’s Mfg. Co./Architectural Series.
    c. Potter Roemer/Alta Series.
    d. Substitutions: Refer to Section 01 25 00.

2. Cabinet Depth: Provide cabinets designed for space available in walls with fire extinguisher cabinets, and of depth to house 2A-10BC multi-purpose dry chemical fire extinguisher.

3. Food Preparation Areas: Provide cabinets designed to house K Type fire extinguisher at locations indicated on Drawings or designated as food preparation areas where burning grease could be encountered.

4. Hazardous Areas (Garage): Provide cabinets designed to house 4A-60BC multi-purpose dry chemical type fire extinguisher at locations indicated on Drawings or designated as hazardous.

5. Trim: Manufacturer's standard edge trim for specified models.

6. Metal Gages: Provide manufacturer's standard gages for specified cabinets.

7. Construction: Mitered and welded one-piece tubular door frames; weld joints and grind smooth; manufacturer's standard steel box with white baked enamel interior finish and primed exterior finish.

    a. Steel Doors and Trim: Manufacturer's standard, prime coat finished.
    b. Doors: Break-glass type secured access, with inside latch and lock.
    c. Door Hardware: Continuous hinge permitting door to open 180 degrees.

C. Surface Mounted Fire Extinguisher Cabinets:

1. Types:

    a. J.L. Industries/Ambassador Series.
    b. Larsen’s Mfg. Co./Architectural Series.
    c. Potter Roemer/Alta Series.
    d. Substitutions: Refer to Section 01 62 00.

2. Cabinet Depth (Typical): Provide cabinets designed for space available in walls with fire extinguisher cabinets, and of depth to house 2A-10BC multi-purpose dry chemical type fire extinguisher.

3. Type: Fully exposed, mounted directly to wall, with manufacturer’s standard rolled edge trim based on specified cabinets.

4. Metal Gages: Provide cabinets fabricated of minimum 18-gage throughout, 20-gage permitted for back.

5. Construction: One-piece tubular door frames mitered and welded; weld joints and grind smooth; manufacturer's standard steel box with white baked enamel interior finish and primed exterior finish.

    a. Steel Doors and Trim: Manufacturer's standard, prime coat finished.
    b. Doors: Break-glass or similar secured access panel, with inside latch and lock.
    c. Door Hardware: Continuous type hinge permitting door to open 180 degrees.

B. Fire Rated Wall Construction (Trimless and Semi-Recessed): Provide fire extinguisher cabinet manufacturer's materials as required to maintain integrity of fire rated partitions where cabinets are in fire rated partitions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which fire extinguisher cabinets are to be installed.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinets in locations and at mounting height to comply with requirements of governing authorities; prepare recesses in walls as required.

B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

1. Wherever exact location of units is not shown, locate as directed by Architect.

3.3 IDENTIFICATION

A. After installation and finishing is completed, silkscreen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.

B. Letter size, style and location as selected by Architect.

END OF SECTION

SECTION 10 44 10

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide wall bracket mounted portable fire extinguishers with accessories for complete installation.

B. Related Sections:

1. Division 21: Fire protection systems.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. J.L. Industries.

B. Larsen’s Manufacturing Co.

C. Potter Roemer.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide portable fire extinguishers with accessories.

B. Fire Extinguishers: Rechargeable types.

1. Typical: Provide 2A-10BC multi-purpose dry chemical fire extinguisher.

2. Hazardous Areas (Garage): Provide 4A-60BC multi-purpose dry chemical fire extinguisher at locations indicated on Drawings or designated as hazardous.

3. Food Preparation Areas: Provide K Type fire extinguisher at locations indicated on Drawings or designated as food preparation areas where burning grease could be encountered.

C. Brackets: Manufacturer's standard quick release wall mounting system designed for seismic zones, with fasteners suitable for wall types indicated, and with accessories as required for complete finished installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fire extinguishers in locations and at mounting height to comply with requirements of governing authorities.

B. Securely fasten brackets to structure, square and plumb, in accordance with manufacturer's instructions.

1. Wherever exact location of units is not shown, locate as directed by Architect.

3.2 IDENTIFICATION

A. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.

B. Letter size, style and location as selected by Architect.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. Product Data: Submit brochures for the following materials to the Architect in accordance with the provisions of Division 1 of these specifications.

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

1.5 QUALITY ASSURANCE

A. Codes and Standards:

1. All governing Codes, Ordinances and Agencies, in accordance with the provisions of Division 1 of these specifications.

B. Warranty: In accordance with the provisions of Division 1 of these specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 DISCREPANCIES

A. The Contractor shall check all Drawings furnished immediately upon their receipt and shall promptly notify the School District's Representative of any discrepancies.

B. Where requirements between Drawings and Specifications conflict, the more restrictive provisions shall apply.

C. If any part of the Specifications or Drawings appears unclear or contradictory, apply to School District's Representative for interpretation and decision as early as possible, including during bidding period. Do not proceed with such work without School District's Representatives decision. Beginning work of any Section constitutes acceptance of conditions.

1.8 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in PLUMBING SPECIALTIES Section 221119.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.

b. Dresser Industries, Inc.; DMD Div.

c. JCM Industries.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics, or equal.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc., or equal.

D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC., or equal.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Epco Sales, Inc.

b. Watts Industries, Inc.; Water Products Div.

c. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Epco Sales, Inc.

b. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Calpico, Inc.

b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Precision Plumbing Products, Inc.

b. Sioux Chief Manufacturing Co., Inc.

c. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Calpico, Inc.

b. Metraflex Co.

c. Thunderline “Line-Seal”.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening. Polished chrome-plated with set screw.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and

calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as closely as practical to routing indicated on plans.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

    b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

    c. Insulated Piping: One-piece, stamped-steel type with spring clips.

    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

    e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

    f. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

    g. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/2 inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.

b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with approved firestop materials, equal to Hilti.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. METERS AND GAGES FOR PLUMBING PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install the following meters and gages for mechanical systems:

1. Thermometers

2. Gages

3. Test plugs

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1of these specifications.

B. DOMESTIC WATER PIPING - Section 221116

C. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. All governing Code, Ordinance and Agencies, in accordance with the provisions of Division 1 of these specifications.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Product Certificates: For each type of thermometer, gauge, flowmeter and thermal-energy meter, signed by product manufacturer.

C. Operation and Maintenance Data: For flowmeters and thermal-energy meters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers:

1. Palmer - Wahl Instruments Inc.

2. Weiss Instruments, Inc.

3. Trerice, H.O. Co.

B. Case: Die-cast aluminum or brass, 7 inches long.

C. Tube: Red or blue reading, mercury or organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

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

2.2 PRESSURE GAGES

A. Manufacturers:

1. Palmer – Wahl Instruments Inc.

2. Trerice, H. O. Co.

3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Liquid-filled type, drawn steel or cast aluminum, 6-inch diameter.

2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.

3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.

4. Movement: Mechanical, with link to pressure element and connection to pointer.

5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

6. Pointer: Red or other dark-color metal.

7. Window: Glass.

8. Ring: Metal.

9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.

10. Vacuum-Pressure Range: 30-inch Hg of vacuum to 15 psig of pressure.

11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.

2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.

3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.3 TEST PLUGS

A. Manufacturers:

1. Flow Design, Inc.

2. MG Piping Products Co.

3. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 degrees F shall be CR.

2. Insert material for air or water service at minus 30 to plus 275 degrees F shall be EPDM.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:

1. Outlet of each domestic water heater.

2. Each domestic hot water return pipe.

B. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 180 degrees F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

C. Install test plugs in tees in piping.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

A. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION

SECTION 22 05 23

GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. GENERAL-DUTY VALVES FOR PLUMBING PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install the following general-duty valves:

1. Ball valves.

2. Check valves.

3. Gate valves.

1.2 RELATED WORK

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 of these specifications.

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

C. IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT - Section 220553

D. DOMESTIC AND RECYCLED WATER PIPING - Section 221116

1.3 REFERENCES

A. American Society of Mechanical Engineers (ASME)

B. American Water Works Association (AWWA)

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. Codes and Standards:

1. All governing Codes, Ordinance and Agencies, in accordance with the provisions of Division 01 of these specifications.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valved dimensions and design criteria.

2. ASME B31.9 for building service piping valves.

C. NSF Compliance: NSF 61-G for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.

3. Set gate valves closed to prevent rattling.

4. Set ball and plug valves open to minimize exposure of functional surfaces.

5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Refer to Valve Applications Article in this Section for applications of valves.

B. Bronze valves shall be made with dezincification-resistant materials.

1. Valves for potable water must comply with California Lead Free Law.

2. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤ 0.25%. Source: California Health Safety Code (116875).

3. All valves must be 3rd party certified.

C. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

D. Ferrous Valves: NPS 2-1/2” and larger with flanged ends, unless otherwise indicated.

E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

G. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.

2. Handlever: For quarter-turn valves NPS 6 and smaller, except plug valves.

3. Locking Handlever: All valves used in recycled water piping shall be provided with locking hand levers.

H. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With non-rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeves that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.

I. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.

2. Solder Joint: With sockets according to ASME B16.18.

3. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. 2 ½ in. and smaller: Two-Piece, Bronze Ball Valves, Dezincification resistant lead free bronze body with full-port, stainless steel ball and trim; TFE seats; and 600-psig minimum cold working pressure rating and blowout-proof stem, MSS SP-110, NSF-61-G. Provide with locking lever handle feature where used in recycled water piping.

1. Manufacturers:

a. Conbraco Industries, Inc.; Apollo Division: Model 77CLF-100 Series

b. NIBCO INC., Model T-685-80-66-LF

B. 3 in. and larger: Two-Piece, Bronze Ball Valves: Dezincification resistant lead free bronze body with standard-port, chromium-plated ball and trim; RPTFE seats; and 600-psig minimum cold working pressure rating and blowout-proof stem. Provide with locking lever handle feature where used in recycled water piping.

1. Manufacturers:

    a. Conbraco Industries, Inc.; Apollo Division: Model 70LF-100 Series

2.3 BRONZE CHECK VALVES

A. 3 in. and smaller: Y-pattern, Class 125, Bronze, and Horizontal Swing Check Valves: Dezincification resistant lead free bronze body with renewable nonmetallic disc and bronze seat, MSS SP-80.

1. Manufacturers:

    a. Conbraco Industries, Inc.; Apollo Division: Model 61Y-LF Series

    b. NIBCO INC., Model T-413-Y-LF

2.4 BRONZE GATE VALVES

A. 3 in and smaller: Bronze Alloy construction, screw-in bonnet, Non-rising stem, Lead-Free bronze body with bronze solid wedge, dezincification Resistant, MSS SP-80.

1. Manufacturers:

    a. NIBCO INC., Model S or T-113-LF

    b. Conbraco Industries, Inc.; Apollo Division: Model 30-LF Series.

2.5 DUCTILE-IRON GATE VALVES

A. 4” and larger: Class 125, Bolted Bonnet, non-rising stem, resilient-wedge, flanged ends, 250 psi, epoxy coated inside and outside, ductile iron body, Lead-Free.

1. Manufacturers:

    a. NIBCO INC., Model F-619-RW

2.6 SPRING-LOADED CHECK VALVES

A. In-Line Check Valve: 2 in. and smaller; Lead-Free Bronze body, threaded, stainless steel spring, 400 psi CWP.

1. Manufacturers:

    a. NIBCO, INC., Model T-413-Y-LF.

    b. Conbraco Industries, Inc., Apollo Division: Model CVB-61-100-LF Series.

B. Dual Check Valve: 2 in. and smaller; Lead-Free composite body, corrosion resistant internal parts, and two (2) independently operated in-line spring-loaded modular checks.

1. Manufacturers:

a. Wilkins Model 705-XL.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate valves.

2. Throttling Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:

1. Ball Valves: NPS 2 ½ in. and Smaller; Bronze Lead-Free Ball Valves, Two-piece, Full-Port, 600-psig CWP rating with stainless steel ball. NPS 3 in and larger; Bronze Lead-Free Ball Valves, Two-piece, standard-port, 600 psi CWP rating with chromium-plated ball.

2. Swing Check Valves, NPS 3 and Smaller: Lead-Free, “Y”-Pattern, Class 125, bronze.

3. Swing Check Valves, NPS 4 and Larger: Type II, Class 125, ductile iron.

4. Spring-Loaded Check Valves, NPS 2 and Smaller: Class 125, Bronze, stainless steel spring.

5. Gate Valves, NPS 3 in. and smaller: Lead-Free, Bronze, non-rising stem, Lead-Free, Class 125. NPS 4 in. and larger; Ductile iron body, Lead-Free, epoxy coated, flanged ends.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

2. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Hangers and supports for plumbing piping and equipment consists of furnishing transportation, labor, materials and equipment to furnish and install the following:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

1.2 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 22 Section "Noise, Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.

2. Thermal-hanger shield inserts.

3. Powder-actuated fastener systems.

4. Pipe positioning systems.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Welding shall be performed only by qualified welders, and shall comply with ASME Boiler Construction Code, ANSI Code and State of California requirements.

B. Codes and Standards:

1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.
3. Hilti Inc.
4. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Hilti Inc.
4. Tolco Inc.
5. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Co.

2. Pipe Shields, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.

b. ITW Ramset/Red Head.

c. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.

b. Hilti, Inc.

c. ITW Ramset/Red Head.

d. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

    a. ERICO/Michigan Hanger Co.

    b. MIRO Industries.

C. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.

2. HOLDRITE Corp.; Hubbard Enterprises.

3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.

2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.

5. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

6. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.

7. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

9. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.

10. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

11. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

12. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

13. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.

14. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

15. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

16. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

10. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

11. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.

    b. Medium (MSS Type 32): 1500 lb.

    c. Heavy (MSS Type 33): 3000 lb.

12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.

    b. Vertical (MSS Type 55): Mounted vertically.

    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Section "Roof Accessories" for curbs.

H. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers,

NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

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

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

    c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

    b. NPS 4: 12 inches long and 0.06 inch thick.

    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

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

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in 09

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Identification for plumbing piping and equipment consists of furnishing transportation, labor, materials, and equipment to furnish and install the following:

1. Pipe labels.

2. Valve tags.

3. Water heater Labels

1.2 RELATED DOCUMENTS

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

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 QUALITY ASSURANCE

A. Codes and Standards:

1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications

PART 2 - PRODUCTS

2.1 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/4 inches high for pipe sizes 2-1/2 to 6 inches, 3/4 inch high for pipe sizes 1-1/2 to 2 inches and 1/2 high for pipe sizes 1/2 to 1-1/4 inches.

3. Color Field Length: At least 12 inches for pipe sizes 2-1/2 to 6 inches and 8 inches for pipe sizes 1/2 to 2 inches.

4. Non-potable water systems shall have the words “CAUTION: NON-POTABLE WATER, DO NOT DRINK” in upper case lettering.

2.2 VALVE TAGS

A. Valve Tags: Provide a valve tag consisting of a 2 in. dia., 20 ga. brass disk for each valve with 1/2 in. letters identifying service designation. Fasten tags in place with continuous chain around valve stem.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:

a. Background Color: Green.

b. Letter Color: White.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Green.

b. Letter Color: White.

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. PLUMBING PIPING INSULATION consists of furnishing transportation, labor, materials, and equipment to furnish and install piping insulation including preformed, rigid and flexible pipe insulation; field-applied jackets; accessories and attachments; and sealing compounds.

1.2 RELATED WORK

A. COMMON WORK RESULTS FOR PLUMBING - Section 220500

B. HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT - Section 220529

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM International)

1.4 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

1.5 QUALITY ASSURANCE

A. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

B. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

C. Codes and Standards:

1. All governing Codes, Ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT Section.

B. Coordinate clearance requirements with piping Installer for insulation application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass Fiber Insulation:

1. Johns-Manville

2. Pittsburgh-Corning Corporation

B. Closed-Cell Phenolic-Foam Insulation:

1. Kooltherm Insulation Products, Ltd.

2.2 INSULATION MATERIALS

A. Glass Fiber Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.

1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C552, Type II, Class 1.

2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C552, Type II, Class 2.

3. Closed-Cell Phenolic-Foam Insulation: Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C1126, Type III, Grade 1.

B. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.

2. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.

3. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.

4. Adhesive: As recommended by insulation material manufacturer.

D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.

2. Adhesive: As recommended by insulation material manufacturer.

E. Aluminum Jacket: Factory cut and rolled to indicate sizes. Comply with ASTM B209, 3003 alloy, H-14 temper.

1. Finish and Thickness: Smooth finish, 0.010 inch thick.

2. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.

3. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 ounces per square yard.

1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A666, Type 304; 0.020 inch thick.

2. Galvanized Steel: 0.005 inch thick.

3. Aluminum: 0.007 inch thick.

4. Brass: 0.010 inch thick.

5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.

2. Circumferential Joints: Cover with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches on center.

3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.

a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.

5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.

2. Apply insulation for exterior applications tightly joined to interior insulation ends.

3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in FIRESTOPPING Section.

T. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 GLASS FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.

2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.

3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches on center.

4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of the same thickness as pipe insulation.

4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When premolded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with wire, tape, or bands.

3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.

2. Apply insulation to flanges as specified for flange insulation application.

3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.

2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.

3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches on center.

4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.

4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.

3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When premolded sections of insulation are not available, apply mitered segments of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.

3. Apply insulation to flanges as specified for flange insulation application.

4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.

2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.

3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.

2. Apply lap or joint strips with the same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

D. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches on center and at end joints.

3.7 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.

2. Vibration-control devices.

3. Fire-suppression piping.

4. Drainage piping located in crawl spaces, unless otherwise indicated.

5. Below-grade piping, unless otherwise indicated.

6. Chrome-plated pipes and fittings, unless potential for personnel injury.

7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.8 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.9 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot, tempered hot water.

1. Operating Temperature: 60 to 165 degrees F.

2. Insulation Material: Cellular glass fiber, with jacket.

3. Insulation Thickness: Apply the following insulation thicknesses:

a. Copper Pipe, 1/2 in to 1 inch: 1 inch thick.

b. Copper Pipe, 1-1/4 inch and larger: 1-1/2 inches thick.

4. Field-Applied Jacket: Foil and paper at mechanical rooms where piping is exposed.

5. Vapor Retarder Required: Yes.

6. Finish: None.

B. Service: Condensate drain.

1. Operating Temperature: 35 to 60 degrees F.

2. Insulation Material: Closed-cell phenolic foam.

3. Insulation Thickness: Apply the following insulation thicknesses:

a. Copper Pipe, 1/2 inch to 1 inch: 1/2 inch thick.

b. Copper Pipe, 1-1/4 inches and larger: 1/2 inch thick.

C. Finish: None.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. DOMESTIC WATER PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install domestic water piping inside the building to 5 feet outside the building.

1.2 RELATED SECTIONS

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

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

C. METERS AND GAGES FOR PLUMBING PIPING - Section 220519

D. PLUMBING SPECIALTIES - Section 221119

1.3 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, couplings and sterilization report.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

C. Codes and Standards:

1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications

D. Comply with the California Department of Health Services, Coachella Valley Water District requirements.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Materials when not otherwise definitely specified shall conform to the applicable standards.

2.2 DOMESTIC HOT and COLD WATER PIPE AND FITTINGS

A. Above Ground: ASTM B 88, ANSI B16.22, Type L, hard drawn copper tube and wrought copper fittings with soldered joints.

B. Below Ground: ASTM B88, ANSI B16.22, Type K hard drawn copper tube and wrought copper fittings with soldered joints.

2.3 MATERIALS FOR JOINTS, FITTINGS AND VALVES

A. Solder and Flux:

1. Equivalent to Harris “Bridget” lead-free solder alloy, ASTM B813 liquid and paste flux. 95-5 soldiers are not approved. Below ground piping shall have brazed joints with silver solder.

2.4 VALVES

A. Bronze and cast-iron, general-duty valves are specified in GENERAL-DUTY VALVES Section.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in EARTHWORK and TRENCHING AND BACKFILLING Sections.

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing 2 in. and larger.

D. Water-Service Piping on Service Side of Water Meter: Refer to WATER DISTRIBUTION Section.

E. Under-Building-Slab, (allowed only at areas as indicated on Drawings), Domestic and Recycled Water, Trap primer, NPS 1 and Smaller: Hard copper tube, Type K.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements shall apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.

2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.

3. Drain Duty: Hose-end drain valves.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in COMMON WORK RESULTS FOR PLUMBING Section.

B. Install under-building-slab copper tubing in conformance with to CDA's Copper Tube Handbook.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in COMMON WORK RESULTS FOR PLUMBING Section.

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in COMMON WORK RESULTS FOR PLUMBING Section.

E. Install shutoff valve, inside the building at domestic water service entrance.

F. Install domestic water piping level without pitch.

G. Wrap underground copper pipe with a minimum of 8 mils of dielectric (nonconductive), continuous “holiday” free (no “open” joints or seams; no holes or tears) polyethylene sleeve. All seams and other openings must be sealed with polyethylene tape. Do not tape wrap buried copper piping. Backfill copper piping with clean sand a minimum of 4 inches all around pipe and fittings.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in COMMON WORK RESULTS FOR PLUMBING Section.

B. Soldered Joints: Use ASTM B813, water-flushable, lead-free flux; ASTM B32, lead-free-alloy solder; and ASTM B828 procedure, unless otherwise indicated.

C. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

D. Brazed Joints: Construct joints according to AWS “Brazing Handbook” Pipe and Tube chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

3.6 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint Devices: NOISE, VIBRATION AND SEISMIC CONTROLS OF PLUMBING PIPING AND EQUIPMENT Section.

B. Pipe Hanger and Support Devices are specified in HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT Section. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports in conformance with HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT Section.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

F. Install hangers for copper tubing in compliance with the CPC.

G. Install supports for vertical copper tubing in compliance with the CPC.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:

1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to PLUMBING FIXTURES Section.

3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 3 and larger.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic and recycled water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in piping. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

3. Leave domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

C. Domestic water systems shall undergo a complete thorough cross-connection test witnessed by local Water District and the Health Department prior to being placed into service.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.

b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 11 19

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. PLUMBING SPECIALTIES consists of furnishing transportation, labor, materials, and equipment to furnish and install the following plumbing specialties:

1. Key-operation hydrants.
2. Trap seal primer valves.
3. Miscellaneous piping specialties.
4. Access Panels.
5. Flashing materials.
6. Cleanouts.
7. Drains.

1.2 RELATED WORK

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

B. METERS AND GAGES FOR PLUMBING SYSTEMS - Section 220519

C. COMMON WORK RESULTS FOR PLUMBING

1.3 REFERENCES

A. American Water Works Association (AWWA)

B. American Society of Testing and Materials (ASTM)

C. American Society of Sanitation Engineers (ASSE)

D. American Society of Mechanical Engineering (ASME)

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.
2. Sanitary Waste and Vent Piping: 10-foot head of water.

3. Storm Drainage Piping: 10-foot head of water.

1.5 QUALITY ASSURANCE

A. Codes and Standards:

1. All governing Codes, Ordinances and Agencies, in accordance with the provisions of Division 1 of these specifications.

1.6 SUBMITTALS

A. Product Data:

1. Water hammer arresters, air vents, and trap seal primer valves and systems.

2. Hose bibbs.

3. Cleanouts, floor drains, open receptors and roof drains.

4. Vent caps, vent terminals, and roof flashing assemblies.

5. Sleeve penetration systems.

B. Operation and Maintenance Data:

1. Trap seal primer valves and systems.

2. Hose bibbs.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze. Wilkins Model BFZP-8.

2.2 TRAP SEAL PRIMER VALVES

A. TP-1: Piston Operated Trap Seal Primer Valves: ASSE 1018, pressure drop activated, with distribution unit as required.

1. Manufacturers:

a. Precision Plumbing Products Model P-1 or P-2, or equal.

2. Provide for drains and floor sinks where trap primer is not provided from a water closet and as indicated and specified, each including trap primer valve, standpipe, and distribution unit(s) required for the specified distribution. Provide each concealed assembly with access panel, 8 in. by 8 inch size when distribution units are not required and 12 inches by 12 inches size when one or

two distribution units are required. Provide trap primer piping same as specified for domestic water, including pipe wrapping.

2.3 MISCELLANEOUS PLUMBING SPECIALTIES

A. Hose Bibbs:

1. HB-1: Equivalent to Acorn 8120CP-LF, heavy rough brass body furnished with lockshield bonnet and a removable loose key wheel handle.

B. Access Panels:

1. Access Panels in Plaster Walls and Ceilings: Karp #DSC214PL, Elmdor PW, 24x24 in. with metal access door and frame, prime coated steel and painted to match adjacent surfaces. For fire rated areas use Karp #KRP-150 FR 1-1/2 hour "B" Label access panels, U.L. listed.

2. Access Panels in Acoustic Tile Ceilings: Karp #DSC-210, Elmdor AT, 24x24 in. with metal access door and frame, 24x24 in. minimum size, prime coated steel, recessed to accept standard tile in full opening door.

3. Access Panels in Ceramic Tile Walls: Karp #DSC214M, Smith 4730, chrome-plated cover and frame of suitable size for purpose intended, but not less than 8x8 in. size. For fire rated areas use Karp #FRP-150 FR 1-1/2 hour "B" Label access panels, U.L. listed.

C. Roof Flashing Assemblies: Manufactured assembly made of 4 pounds per square foot, 0.0625-inch- thick, one piece lead flashing collar and skirt extending at least 6 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

1. Sanitary Vent Flashing: Semco 1100-3 or 1100-5, one-piece lead flashing and counter flashing sleeve.

2. Other Pipe Thru Flashing: Semco 1100-2 or 1100-4, one-piece, 4 lb. lead flashing and counter flashing sleeve.

3. Low-Silhouette Vent Cap: With vandal-proof vent cap.

2.4 SLEEVE PENETRATION SYSTEMS

A. Fire-rated wall and floor penetrations shall be made with U. L. listed fire safing installed in conformance with manufacturers directions.

1. Manufacturers:

2. Hilti.

a. Pro-set.

b. Nelson.

B. Description: UL 1479, through-penetration firestop assembly through fire rated walls and floors.

C. Provide at concrete or masonry exterior bearing walls: Wall sleeves shall be flush with finished surface. Sleeves shall be sized to allow 1/2 in. clearance around pipe or insulation. Insulation and covering shall be continuous through sleeves.

1. Manufacturers:

2. Adjust-to-Crete

a. Paramount.

b. Sperzel Cretesleeve.

D. At exterior walls below grade provide a modular mechanical seal consisting of interlocking EPDM rubber links shaped to continuously fill the annular space between the pipe and the wall opening with a molded high density polyethylene sleeve water-stop ring, end caps and reinforcing ribs. ASTM B117, ISO 9002. Mechanical seals shall be "Thunderline" Link Seal.

2.5 CLEANOUTS

A. For cast-iron soil pipe, iron body with extra heavy bronze plugs screwed into caulking ferrules; for steel pipe, extra heavy bronze plugs; and for vitrified clay pipe, vitrified clay plugs. Where cleanouts occur in finished interior walls, provide access panels, plates, and frames for flush mounting. Exposed parts of floor cleanouts shall have adjustable top. All cleanouts and cleanout plugs shall be accessible. Cleanout shall be the following:

1. In finished floors: Cast-iron with polished nickel bronze round top, non-skid diamond tread set flush with the floor. Provide with carpet marker when located in future carpeted areas and flashing flange when used with waterproofing membrane.

a. Smith - 4023

b. Wade - W-6000

c. Zurn - ZN-1420-2

2. In walls: Cleanout tee with squared polished nickel bronze access plate with vandalproof screws and frames. Opening 8 inches by 8 inches minimum.

a. Smith - 4558-U

b. Wade - W-8460-S

c. Zurn - ZN-1447

3. In exterior grades: Cast-iron body, vandalproof cover, non-skid diamond tread, set flush with grade or finished surface. In non-surfaced area, they shall be cast in a concrete block 14 inches by 14 by 6 inches deep.

    a. Smith - 4248

    b. Wade – 6010-Z-75

2.6 FLOOR DRAINS, FLOOR SINKS, AND AREA DRAINS

A. Floor Sink (FS-1)

1. 8 ½" inch square, 4 inch wide flange, 6 inch deep acid-resisting enameled cast-iron drain with stainless steel rim and grate, sediment bucket and anchor flange with membrane clamp. Provide partial grate for discharge pipes.

    a. Smith – 3100Y

B. Floor Sink (FD-1)

1. 5" inch diameter, 4 inch wide flange, 4 inch deep Duco Cast Iron body with flashing clamp and adjustable strainer head. with nickel bronze heel-proof grate and trap primer connection.

    a. Smith – 2005Y

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to COMMON WORK RESULTS FOR PLUMBING Section 220500 for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers as indicated on plans.

2. Install drain for backflow preventers with fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to receptor. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

D. Install strainers on supply side of each pressure regulator, and solenoid valve.

E. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

F. Install expansion joints on vertical risers, stacks, and conductors if indicated.

G. Install cleanout deck plates with top flush with finished floor for floor cleanouts on piping below floors.

H. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

I. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

J. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

K. Install drains at low points of surface areas to be drained as indicated on the architectural drawings. Set grates of drains flush with finished floor, unless otherwise indicated.

L. Install roof drains at low points of roof areas as indicated on the architectural Drawings.

M. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

N. Fasten recessed-type plumbing specialties to reinforcement built into walls.

O. Install blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

P. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. See GENERAL-DUTY VALVES Section 220523 for general-duty ball, butterfly, check, gate, and globe valves.

Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 22 Sections.

D. Connect plumbing specialties and devices that require power conforming to Division 22 Sections.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Department maintenance personnel to adjust, operate, and maintain plumbing specialties.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. SANITARY WASTE AND VENT PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install the following for soil, waste, and vent piping inside the building:

1. Pipe and fittings.

2. Special pipe fittings.

3. Encasement for underground metal piping.

1.2 RELATED WORK

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

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM International)

B. American Water Works Association (AWWA)

C. Cast Iron Soil Pipe Institute (CISPI)

D. Sheet Metal and Air Condition Contractor's National Association (SMACNA)

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be in conformance with the SMACNA Guidelines.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Codes and Standards:

1. All governing Codes, Ordinances and Agencies in accordance with the provisions of Division 1 of these specifications.

PART 2 - PRODUCTS

2.1 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings:

1. Soil, waste, vent and storm drain piping to 5 feet outside building: Cast-iron soil pipe and fittings conforming to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the Engineer. Wrap all underground piping per paragraph 3.3 G, 1 herein.

a. Manufacturers:

1) Tyler Pipe

2) A.B. & I.

3) Charlotte Pipe and Foundry

B. Shielded Couplings: ASTM C1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Above Ground: Type 300 Series stainless steel, "No-Hub" standard duty, shielded couplings as approved by the Cast Iron Soil Pipe Institute, CISPI-310-85 with stainless steel corrugated shield, stainless steel bands and tightening devices and ASTM C564 rubber sleeve. Equivalent to Tyler.

2. Below Ground: Type 304 stainless steel, "No-Hub" by the Cast Iron Soil Pipe Institute, CISPI-310-85 with stainless steel shield, stainless steel band and tightening devices and ASTM C564 rubber sleeve. Equivalent to Husky HD-2000.

a. Manufacturers:

1) Clamp-All Corporation

2) Husky Technologies.

3) Tyler Pipe; Soil Pipe Division

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to EARTHWORK and TRENCHING AND BACKFILLING Sections for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Soil and waste piping shall be hubless cast-iron soil pipe and fittings; standard-duty shielded, stainless-steel couplings; and hubless-coupling joints.

B. Vent piping shall be hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in civil drawings.

B. Basic piping installation requirements are specified in COMMON WORK RESULTS FOR PLUMBING Section 220500.

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in PLUMBING SPECIALTIES Section 221119.

E. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

F. Install cast-iron soil piping in conformance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Where soil is corrosive install 8 mil. Polyethylene encasement on underground piping in conformance with ASTM A674 or AWWA C105/ANSI AZ1.5. Backfill with clean sand a minimum of 4 inches all around pipe and fittings.

G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Install soil and waste drainage piping at 2 percent minimum slope, unless otherwise indicated on Drawings:

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in COMMON WORK RESULTS FOR PLUMBING Section 220500.

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in HANGERS AND SUPPORTS FOR PLUMBING PIPING & EQUIPMENT Section 220529. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Install individual, straight, horizontal piping runs in conformance with to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Hangers and Supports Section.

C. Support vertical piping and tubing at base and at each floor.

D. Horizontal cast-iron no-hub piping: Provide hangers or supports at each side of a no-hub fitting.

E. Install hangers for cast-iron soil piping with maximum horizontal spacing and minimum rod diameters in accordance with the requirements of the California Plumbing Code.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by the CPC.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by the CPC.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by the CPC.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of the authorities having jurisdiction or, in absence of published procedures, in accordance with the requirements of the California Plumbing Code.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 22 14 13

STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. STORM DRAINAGE PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install the following storm drainage piping inside the building:

1. Pipe, tube, and fittings.

2. Special pipe fittings.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 apply to this Section.

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM International)

B. Cast Iron Soil Pipe Institute (CISPI)

C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

D. American Water Works Association (AWWA)

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

B. Seismic Performance: Piping and support and installation shall be in conformance with the SMACNA Guidelines.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Codes and Standards:

1. All governing Codes, Ordinances and Agencies, in accordance with the provisions of Division 1 of these specifications.

PART 2 - PRODUCTS

2.1 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings:

1. Soil, waste, vent and storm drain piping to 5 feet outside building: Cast-iron soil pipe and fittings conforming to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer. Wrap all underground piping as specified in this Section.

a. Manufacturers:

1) Tyler Pipe

2) A.B. & I.

3) Charlotte Pipe and Foundry.

B. Shielded Couplings: ASTM C1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Above Ground: Type 300 Series stainless steel, "No-Hub" standard duty, shielded couplings as approved by the Cast Iron Soil Pipe Institute, CISPI-310-85 with stainless steel corrugated shield, stainless steel bands and tightening devices and ASTM C564 rubber sleeve. Equivalent to Tyler.

2. Below Ground: Type 304 stainless steel, "No-Hub" by the Cast Iron Soil Pipe Institute, CISPI-310-85 with stainless steel shield, stainless steel band and tightening devices and ASTM C564 rubber sleeve. Equivalent to Husky HD-2000.

a. Manufacturers:

1) Clamp-All Corporation

2) Husky Technologies

3) Tyler Pipe; Soil Pipe Division

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to EARTHWORK and TRENCHING AND BACKFILLING Sections for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Storm drainage piping inside building shall be hubless cast-iron soil pipe and fittings; standard-duty shielded, stainless-steel couplings; and hubless-coupling joints.

3.3 PIPING INSTALLATION

A. Storm drainage piping outside the building downstream of point of connection (POC) are specified in civil drawings.

B. Basic piping installation requirements are specified in COMMON WORK RESULTS FOR PLUMBING Section 220500.

C. Install seismic restraints on piping. Seismic-restraint devices are specified in NOISE, VIBRATION AND SEISMIC CONTROLS OF PLUMBING PIPING AND EQUIPMENT Section 220548.

D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in PLUMBING SPECIALTIES Section 221119.

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in PLUMBING SPECIALTIES Section 221119.

F. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Where soil is corrosive install 8 mil. polyethylene encasement on underground piping in conformance with ASTM A674 or AWWA C105/ANSI A21.5. Backfill with clean sand a minimum of 4 inches all around pipe and fittings.

H. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in COMMON WORK RESULTS FOR PLUMBING Section 220500.

B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in NOISE, VIBRATION AND SEISMIC CONTROLS Section 220548.

B. Pipe hangers and supports are specified in HANGERS AND SUPPORTS Section 220529. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

c. Longer Than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports in conformance with HANGERS AND SUPPORTS Section 220529.

D. Support vertical piping and tubing at base and at each floor.

E. Horizontal cast-iron no-hub piping: Provide hangers or supports at each side of a no-hub fitting.

F. Install hangers for cast-iron soil piping with maximum horizontal spacing and minimum rod diameter in accordance with the requirements of the California Plumbing Code.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction before inspection must be

made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to the procedures of authorities having jurisdiction or, in absence of published procedures, in accordance with the requirements of the California Plumbing Code.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 22 33 00

ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following electric water heaters:

1. Commercial, storage electric water heaters.

2. Compression tanks.

3. Water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to SMACNA Guidelines.

1. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified”.

1.4 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals.

C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

F. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.

b. Faulty operation of controls.

c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:

a. Commercial Electric Water Heaters:

1) Storage Tank: Three years.

2) Controls and Other Components: Three years.

b. Compression Tanks: One year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.

1. Manufacturers:

a. Bradford White Corporation.

b. Lochinvar Corporation.

c. A.O. Smith.

d. EEMAX

2. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement, glass lined.

a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

b. Pressure Rating: 150 psig.

3. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Extruded high density.

b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.

c. Insulation: Comply with ASHRAE/IESNA 90.1.

d. Jacket: Steel with enameled finish.

e. Heating Elements: Medium watt density with zinc-plated copper sheath.

f. Temperature Control: Adjustable thermostat.

g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.

h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.

5. Capacity and Characteristics:

a. As indicated on Plumbing Drawings.

2.3 COMPRESSION (EXPANSION) TANKS

A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

1. Manufacturers:

a. AMTROL Inc.

b. Watts Regulator Co.

c. Wessels Co.

2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.

b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.

b. Capacity Acceptable: 2 gal. minimum.

c. Air Precharge Pressure: 55 psig.

2.4 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.

C. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.

D. Water Heater Restraint System: Heavy duty water heater seismic restraint system for wall mounting. Install per Manufacturer’s direction and detail on plan.

E. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.

2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install seismic restraints for commercial water heaters. Anchor to substrate.

D. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap above floor sink.

E. Install water-heater drain piping as indirect waste to spill by positive air gap over floor sinks. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.

F. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

G. Fill water heaters with water.

H. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment and connect wiring according to Division 26 Section "General Electrical Specification."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, confirm proper operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and instantaneous electric water heaters. Refer to Division 01 Section "Closeout Procedures, Demonstration and Training."

END OF SECTION

SECTION 22 41 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Plumbing fixtures consists of furnishing transportation, labor, materials, and equipment to furnish and install the following plumbing fixtures and related components:

1. Water closets
2. Lavatories.
3. Insulation kit.
4. Drinking fountains.
5. Mop sinks.
6. Water hammer arrestors.
7. Trap primers.
8. Hose bibbs.
9. Access panels.

B. Accessible Fixtures, CBC Division 6 / 11B:

C. Accessible plumbing fixtures shall comply with all the requirements of CBC Division 6.

D. Heights and location of all fixtures shall be according to the CBC Division 6, Sections 11B-602 through 11B-612; refer to architectural plans.

E. Accessible fixture controls shall comply with CBC Sections 11B - Section 11B-602.3 for drinking fountains; Section 11B-604.6 for water closers; Section 11B-605.4 for urinals; Section 11B-606.4 for lavatories and sinks; Section 11B-608.5 for showers and Section 11B-611.3 for washing machines and clothes dryers.

F. Each accessible sink shall be a maximum of 6-1/2” deep. Sinks shall be mounted with the counter or rim no higher than 34” above the finish floor.

G. Hand-operating metering faucets shall remain open for 10 seconds minimum per CBC Section 11B-606.4.

H. All single-user toilet facilities shall be identified as Gender-Neutral facilities by a door symbol in accordance with CBC Section 11B-216.8 and 11B-703.2.6.3; refer to architectural plans.

I. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1; refer to architectural plans.

J. Fixtures and accessories provided in a toilet room shall comply with CBC Section 11B-213.2 through 11B-213.3; refer to architectural plans.

K. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7.

L. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5.

M. Performance, Cal Green – refer to table 5.303.3 on sheet P0.1:

N. Flush Valves: Flushometer valve type single flush with maximum volume of 1.28 gallons per flush (gpf) for water closets and 0.125 gallons per flush (gpf) for urinals.

O. Faucets: Public lavatories shall be equipped with faucets with a maximum flow of 0.5 gallons per minute (gpm). Kitchen faucets shall be equipped with a maximum flow rate of 1.8 gallons per minute (gpm).

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI A117.1 – Accessible and Usable Buildings and Facilities

2. ANSI Z358.1 – Emergency Eyewash and Shower Equipment

B. Air Conditioning and Refrigeration Institute:

1. ARI 1010 – Self-contained, Mechanically Refrigerated Drinking Water Coolers

C. American Society of Mechanical Engineers

1. ASME A112.6.1 – Floor-Affixed Supports for Off-the Floor Plumbing Fixtures for Public Use.

2. ASME A112.18.1 - Plumbing Fixture Fittings.

3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.

4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.

5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).

6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.

7. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 RELATED DOCUMENTS

A. COMMON WORK RESULTS FOR PLUMBING Section 22 05 00

B. HANGERS & SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT Section 22 05 29

C. JOINT SEALANTS PROTECTION Section 07 92 00.

D. EQUIPMENT WIRING CONNECTIONS Section 26 00 00.

E. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

1.4 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

C. FRP: Fiberglass-reinforced plastic.

D. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.5 SUBMITTALS

A. Section 01 30 00 – Administrative Requirements: Submittal Procedures

B. Manufacturer's Literature: Submit brochures on all materials and equipment to the Engineer.

C. Other Submittals:

1. Shop Drawings.

2. Sterilization Test Report.

3. Test Data.

4. Operations and Maintenance Manuals.

5. Record Drawings.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

PART 2 - PRODUCTS - Refer to sheet P9.1 Fixture and Equipment Schedules. Listed products on sheet P9.1 supersedes fixtures listed herein.

2.1 MANUFACTURERS

A. Flush Valves: As specified; refer to plumbing fixture schedule.

B. Plumbing Fixtures: As specified; refer to plumbing fixture schedule.

C. Toilet Seats: Church, Beneke, Olsonite

D. Faucets: As specified; refer to plumbing fixture schedule, sheet P-001.

E. Refer to food service drawings for specification on plumbing fixtures in kitchen.

2.2 PLUMBING FIXTURES AND TRIMS – Refer to sheet P0-02

A. Water Closet (WC-1): Wall hung, flush valve.

1. Stainless Steel, siphon jet action, elongated bowl, 1.28 gallon flush.

2. Acorn 2105-T-1

3. Acorn hinged seat, open-front seat less cover.

4. Flush Valve: Sloan Royal 111-1.28 flush valve 1.28 GPF.

5. Carrier: Zurn #Z1201-N_4 (Left or Right) Ezcarry, adjustable horizontal high performance siphon jet no-hub water closet carrier.

B. Water Closet (WC-2): Wall Hung, ADA compliant, flush valve.

1. Stainless steel, siphon jet action, elongated bowl, 1.28 gallon flush.

2. Acorn 2105-T-1

3. Acorn hinged seat, open front less cover.

4. Solid plastic white open-front seat less cover: Olsonite 95SSCT.

5. Flush Valve: Sloan Royal 111-1.28 flush valve 1.28 GPF.

6. Do not interfere flush valve with handle bar, see Architectural drawings.

7. Flush valve handle shall be on the wide side of stall.

8. Carrier: Zurn #Z1201-N_4 (Left or Right) Ezcarry, adjustable horizontal high performance siphon jet no-hub water closet carrier.

C. Water Closet (WC-3): Floor Mounted, ADA compliant, flush valve.

1. Vitreous china, siphon jet action, elongated bowl, 1.28 gallon flush.

2. Acorn Meridian #2141-T-3-ADA-FM Series

3. Acorn hinged seat, open front less cover.

4. Flush Valve: Sloan Royal 111-1.28 flush valve 1.28 GPF.

5. Do not interfere flush valve with handle bar, see Architectural drawings.

6. Flush valve handle shall be on the wide side of stall.

D. Lavatory (L-1)(Student): Wall-hung, A.D.A. Stainless Steel, 21 1/2 x 19 in. off-floor, wall mounted.

1. Acorn Meridian #3701-1-H-DMJ, Push Button hand operation, Deck mounted “J” spout.

2. Faucet: Angle Stops and Supplies: Equivalent to McGuire LFH “lead-free” Series with solid flexible tube rise. Trap: Chrome-plated 17 gauge tubular brass "P" trap.

E. Lavatory (L-2)(Staff): Wall-hung, A.D.A. Vitreous china, 21 1/2 x 19 in., concealed arms.

1. Acorn Meridian #3701-1-H-DMJ, Push Button hand operation, Deck mounted “J” spout.

2. Faucet: Angle Stops and Supplies: Equivalent to McGuire LFH “lead-free” Series with solid flexible tube rises. Trap: Chrome-plated 17 gauge tubular brass "P" trap.

3. Provide TMV-1, ASSE 1070 Below Deck thermostatic mixing valve similar to Zurn ZW-1070XL.

F. Drinking Fountain (DF-1): Hi-low, filtered, non-refrigerated, barrier-free, vandal resistant; 14-gauge type 304 stainless steel finish basins with push-button operated stainless steel valves complete with sensor-operated bottle filler and wall-mounting plate.

1. Elkay Murdock # GYQ84

2. Service Sink (SS-1): Floor-mounted, with vinyl rim guard

3. American Standard #7741.000, Florwell., floor mounted corner type, rim guard and grid drain.

4. Faucet: Chicago Faucet #897-CCP, chrome-plated, wall-mounted fitting with hose end, vacuum breaker, wall brace, bucket hook, integral stops, 2.5 GPM flow, vandal-proof with pail hook and brace Chicago Faucet 897-CCP.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

C. Use carrier supports with waste fitting and seal for back-outlet fixtures.

D. Use carrier supports without waste fitting for fixtures with tubular waste piping.

E. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

F. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

G. Install wall-mounting fixtures with tubular waste piping attached to supports.

H. Install counter-mounting fixtures in and attached to casework.

I. Install fixtures level and plumb according to roughing-in drawings.

J. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

K. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

L. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

M. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

N. Install toilet seats on water closets.

O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

Q. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

R. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

S. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

T. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.

U. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers. Replace damaged and malfunctioning units.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

B. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

C. Remove sediment and debris from drains.

D. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Engineer.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Equipment installation requirements common to equipment sections.
8. Painting and finishing.
9. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.

2. PE: Polyethylene plastic.

3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.

2. Dielectric fittings.

3. Mechanical sleeve seals.

4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.2 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.4 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.5 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.

2. Torque, speed, and horsepower requirements of the load.

3. Ratings and characteristics of supply circuit and required control sequence.

4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with

indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motors 7.5 HP and larger; rolled steel for motors 7.5 HP smaller than.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multi-speed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multi-speed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal framing systems.

2. Equipment supports.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

3. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.

2. Metal framing systems.

3. Fiberglass strut systems.

4. Pipe stands.

5. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper B-Line, Inc.

b. Thomas & Betts Corporation.

c. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Metallic Coating: Manufacturer’s standard finish.

8. Plastic Coating: Plastic coating, jacket or liner.

2.2 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.3 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

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

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

    b. NPS 4: 12 inches long and 0.06 inch thick.

    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

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

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Freestanding and restrained spring isolators.
5. Housed spring mounts.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Restrained vibration isolation roof-curb rails.
9. Restraining braces and cables.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. 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.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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

1. M.W. Sausse & Company, Inc.

2. Mason Industries.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant rubber.

C. Mounts Insert drawing designation: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

2. Minimum Additional Travel: 50 percent of the required deflection at rated load.

3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.

6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.

2. Base: Factory drilled for bolting to structure.

3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

H. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7. Self-centering hanger rod cap to ensure concentricity between hanger rod and

support spring coil.

I. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

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

1. M.W. Sausse & Company, Inc.

2. Mason Industries.

B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic forces.

C. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch-thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the

installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

    a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.

    b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

    c. Minimum Additional Travel: 50 percent of the required deflection at rated load.

    d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

    e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

    a. Resilient Material: Oil- and water-resistant natural rubber.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counter flashed over roof materials.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

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

1. M.W. Sausse & Company, Inc.

2. Mason Industries.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A

36M. Bases shall have shape to accommodate supported equipment.

3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

2.4 SEISMIC-RESTRAINT DEVICES

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

1. M.W. Sausse & Company, Inc.

2. Mason Industries.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.

2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and

matched to type and size of attachment devices used.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.

3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. 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.

G. 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.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-

duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 FIELD QUALITY CONTROL

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

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. Verify snubber minimum clearances.

9. Air-Mounting System Leak Test: After installation, charge system and test for

leaks. Repair leaks and retest until no leaks exist.

10. Air-Mounting System Operational Test: Test the compressed-air leveling system.

11. Test and adjust air-mounting system controls and safeties.

12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust air-spring leveling mechanism.

D. Adjust active height of spring isolators.

E. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to demonstration and training requirements in Division 01 Section

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Duct labels.
4. Stencils.
5. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel, as required to mount on equipment.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

5. Fasteners: Stainless-steel, as required to mount on equipment.

6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment

schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel, as required to mount equipment.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

E. Fasteners: Stainless-steel, as required to mount equipment.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard.

2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Green: For cold-air supply ducts.

2. Yellow: For hot-air supply ducts.

3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

2. Testing, Adjusting, and Balancing Equipment:

3. Duct leakage tests.

4. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB teleconference after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.

b. The TAB plan.

c. Needs for coordination and cooperation of trades and subcontractors.

d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.

2. Serial number.

3. Application.

4. Dates of use.

5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.

2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, available TAB specialists that may be engaged include, but are not limited to, the following:

1. National Air Balance Company, Inc.

2. MESA3, Inc.

3. Pacific Teat and Balance, Inc.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as zone boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.

2. Strategies and step-by-step procedures for balancing the systems.

3. Instrumentation to be used.

4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.

b. Duct systems are complete with terminals installed.

c. Volume, smoke, and fire dampers are open and functional.

d. Clean filters are installed.

e. Fans are operating, free of vibration, and rotating in correct direction.

f. Variable-frequency controllers' startup is complete and safeties are verified.

g. Automatic temperature-control systems are operational.

h. Ceilings are installed.

i. Windows and doors are installed.

j. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.

b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.

c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.

b. Measure static pressure directly at the fan inlet or through the flexible connection.

c. Measure static pressure across each component that makes up the air-handling system.

d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-

handling-unit performance.

5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.

2. Adjust submain and branch duct volume dampers for specified airflow.

3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.

2. Measure inlets and outlets airflow.

3. Adjust each inlet and outlet for specified airflow.

4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.

2. Re-measure and confirm that total airflow is within design.

3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.

4. Mark all final settings.

5. Test system in economizer mode. Verify proper operation and adjust if necessary.

6. Measure and record all operating data.

7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.

2. Motor horsepower rating.

3. Motor rpm.

4. Phase and hertz.

5. Nameplate and measured voltage, each phase.

6. Nameplate and measured amperage, each phase.

7. Starter size and thermal-protection-element rating.

8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.9 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.

2. Confirm that the sequences of operation are in compliance with Contract Documents.

3. Verify that controllers are calibrated and function as intended.

4. Verify that controller set points are as indicated.

5. Verify the operation of lockout or interlock systems.

6. Verify the operation of valve and damper actuators.

7. Verify that controlled devices are properly installed and connected to correct controller.

8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and

variations from indicated conditions.

3.10 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

3.11 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports as requested by Architect to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.

2. Manufacturers' test data.

3. Field test reports prepared by system and equipment installers.

4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for zone boxes, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fan performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Settings for exhaust-air, static-pressure controller.

g. Other system operating conditions that affect performance.

D. Air-Conditioning-Unit Test Reports: For air-conditioning units, include the following:

1. Unit Data:

a. Unit identification.

b. Location.

c. Make and type.

d. Model number and unit size.

e. Manufacturer's serial number.

f. Unit arrangement and class.

g. Discharge arrangement.

h. Number, make, and size of belts.

i. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Filter static-pressure differential in inches wg.

e. Outdoor airflow in cfm.

f. Return airflow in cfm.

g. Outdoor-air damper position.

E. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.

b. Number of rows.

c. Fin spacing in fins per inch o.c.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.

b. Average face velocity in fpm.

c. Air pressure drop in inches wg.

d. Outdoor-air, wet- and dry-bulb temperatures in deg F.

e. Return-air, wet- and dry-bulb temperatures in deg F.

f. Entering-air, wet- and dry-bulb temperatures in deg F.

g. Leaving-air, wet- and dry-bulb temperatures in deg F.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.

c. Make and type.

d. Model number and size.

e. Manufacturer's serial number.

f. Arrangement and class.

g. Sheave make, size in inches, and bore.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-conditioning-unit number.

b. Location and zone.

c. Traverse air temperature in deg F.

d. Duct static pressure in inches wg.

e. Duct size in inches

f. Duct area in sq. ft.

g. Indicated airflow rate in cfm.

h. Actual airflow rate in cfm.

i. Actual average velocity in fpm.

j. Barometric pressure in psig.

H. Zone Box-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.

b. Location and zone.

c. Apparatus used for test.

d. Area served.

e. Make.

f. Number from system diagram.

g. Type and model number.

h. Size.

i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.

b. Air velocity in fpm.

c. Final airflow rate in cfm.

d. Final velocity in fpm.

e. Space temperature in deg F.

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

3.13 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.

B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

3. If the second verification also fails, Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round and flat oval ducts and fittings.
4. Double-wall round and flat oval ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.
9. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall be furnished installed pursuant to DSA approved drawings.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with

requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.

2. Sealants and gaskets.

3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Factory- and shop-fabricated ducts and fittings.

3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.

4. Elevation of top of ducts.

5. Dimensions of main duct runs from building grid lines.

6. Fittings.

7. Reinforcement and spacing.

8. Seam and joint construction.

9. Penetrations through fire-rated and other partitions.

10. Equipment installation based on equipment being used on Project.

11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

2. Suspended ceiling components.

3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

D. Welding certificates.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 -PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. McGill AirFlow LLC.

b. SEMCO Incorporated.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.

2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.

3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. CertainTeed Corporation; Insulation Group.

    b. Johns Manville.

    c. Knauf Insulation.

    d. Owens Corning.

        1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

        2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

4. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

    b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.

    b. Intervals of lined duct preceding unlined duct.

    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with build outs attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build outs (metal hat sections) or other build out means are optional; when used, secure build outs to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable,

airtight seal.

2. Tape Width: 4 inches.

3. Sealant: Modified styrene acrylic.

4. Water resistant.

5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.

4. Water resistant.

5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).

7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Base: Synthetic rubber resin.

3. Solvent: Toluene and heptane.

4. Solids Content: Minimum 60 percent.

5. Shore A Hardness: Minimum 60.

6. Water resistant.

7. Mold and mildew resistant.

8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

9. VOC: Maximum 395 g/L.

10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

11. Maximum Static-Pressure Class: 10-inch wg , positive or negative.

12. Service: Indoor or outdoor.

13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.

3. Grade: NS.

4. Class: 25.

5. Use: O.

6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

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

1. Hilti Corp.

2. Mason Industries.

3. TOLCO; a brand of NIBCO INC.

B. General Requirements for Restraint Components: Rated strengths, features, and

applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel support systems to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 -EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Outdoor, Supply-Air Ducts: Seal Class A.

3. Outdoor, Exhaust Ducts: Seal Class C.

4. Outdoor, Return-Air Ducts: Seal Class C.

5. Unconditioned Space, Supply-Air Ducts in Pressure Classes

2-Inch wg and Lower: Seal Class B.

6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.

7. Unconditioned Space, Exhaust Ducts: Seal Class C.

8. Unconditioned Space, Return-Air Ducts: Seal Class B.

9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.

10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.

11. Conditioned Space, Exhaust Ducts: Seal Class B.

12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

3. Test for leaks before applying external insulation.

4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

5. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner

manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.

2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged,

deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide drainage and cleanup for wash-down procedures.

7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

B. Supply Ducts:

1. Ducts Connected to gas/electric A.C. units:

a. Pressure Class: Positive 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 24.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 24.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.

b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive

pressure.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.

b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.

c. Welded seams and joints.

d. Pressure Class: Positive or negative 3-inch wg.

e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.

f. SMACNA Leakage Class: 3.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

F. Liner:

1. Supply Air Ducts: Flexible elastomeric, 2 inches thick.

2. Return Air Ducts: Flexible elastomeric, 2 inches thick.

3. Supply Fan Plenums: Flexible elastomeric, 2 inches thick.

4. Return- and Exhaust-Fan Plenums: Flexible elastomeric, 2 inches thick.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards

- Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

b. Velocity 1000 to 1500 fpm: Conical tap.

c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Combination fire and smoke dampers.
7. Flange connectors.
8. Turning vanes.
9. Remote damper operators.
10. Duct-mounted access doors.
11. Flexible connectors.
12. Flexible ducts.
13. Duct accessory hardware.
14. Duct silencers.

B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

PART 2 - PRODUCTS

2.1 SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.

b. Manual volume damper installations.

c. Control damper installations.

d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

e. Duct security bars.

f. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

D. Source quality-control reports.

E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

2.2 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

2.3 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 3 - EXECUTION

3.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: [G60] [G90].

2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

3.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. 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:

1. Air Balance Inc.; a division of Mestek, Inc.

2. Greenheck Fan Corporation.

3. Pottorff; a division of PCI Industries, Inc.

4. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners.

F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Galvanized steel.

2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.

2. Counterweights and spring-assist kits for vertical airflow installations.

3. Electric actuators.

4. Chain pulls.

5. Screen Mounting: Front mounted in sleeve.

a. Sleeve Thickness: 20-gage minimum.

b. Sleeve Length: 6 inches minimum.

6. Screen Mounting: Rear mounted.

7. Screen Material: Galvanized steel.

8. Screen Type: Bird.

9. 90-degree stops.

3.3 BAROMETRIC RELIEF DAMPERS

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

1. Air Balance Inc.; a division of Mestek, Inc.

2. Greenheck Fan Corporation.

3. Pottorff; a division of PCI Industries, Inc.

4. Ruskin Company.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.064-inch- thick, galvanized sheet steel, with welded corners.

F. Blades:

1. Multiple, 0.025-inch-thick, roll-formed aluminum.

2. Maximum Width: 6 inches.

3. Action: Parallel.

4. Balance: Gravity.

5. Eccentrically pivoted.

G. Blade Seals: Vinyl or Neoprene.

H. Blade Axles: Galvanized steel.

I. Tie Bars and Brackets:

1. Material: Galvanized steel.

2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Accessories:

1. Flange on intake.

2. Adjustment device to permit setting for varying differential static pressures.

3.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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. Air Balance Inc.; a division of Mestek, Inc.

b. Pottorff; a division of PCI Industries, Inc.

c. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.

4. Frames:

    a. Hat-shaped, galvanized, 0.064-inch minimum thickness.

    b. Mitered and welded corners.

    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.

    b. Parallel- or opposed-blade design.

    c. Stiffen damper blades for stability.

    d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.

7. Bearings:

    a. Oil-impregnated bronze.

    b. Dampers in ducts with pressure classes of 3-inch wg. or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Air Balance Inc.; a division of Mestek, Inc.

    b. Pottorff; a division of PCI Industries, Inc.

    c. Ruskin Company.

2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

3. Suitable for horizontal or vertical applications.

4. Frames:

    a. Hat shaped.

    b. Galvanized-steel channels, 0.064 inch thick.

c. Mitered and welded corners.

d. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.

b. Parallel- or opposed-blade design.

c. Stiffen damper blades for stability.

d. Galvanized, roll-formed steel, 0.064 inch thick.

6. Blade Axles: Galvanized.

7. Bearings:

a. Oil-impregnated bronze.

b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Blade Seals: Vinyl or Neoprene.

9. Jamb Seals: Cambered stainless steel.

10. Tie Bars and Brackets: Galvanized steel.

11. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size: 1-inch diameter.

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

2. Include center hole to suit damper operating-rod size.

3. Include elevated platform for insulated duct mounting.

3.5 CONTROL DAMPERS

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

1. American Warming and Ventilating; a division of Mestek, Inc.

2. Greenheck Fan Corporation.

3. Ruskin Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.

2. Galvanized-steel channels, 0.064 inch thick.

3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 8 inches.

2. Opposed-blade design.

3. Galvanized steel.

4. 0.064 inch thick.

5. Blade Edging: Closed-cell neoprene edging.

6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Oil-impregnated bronze.

2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

3. Thrust bearings at each end of every blade.

3.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of

the following:

1. Greenheck Fan Corporation.
2. Pottorff; a division of PCI Industries, Inc.
3. Ruskin Company.

B. Type: Fire dampers shall be labeled according to UL 555 by an NRTL.

C. Fire Rating: 1-1/2 or 3 hours.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

3.7 COMBINATION FIRE AND SMOKE DAMPERS

A. 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:

1. Greenheck Fan Corporation.
2. Pottorff
3. Ruskin Company.

B. Combination fire and smoke dampers shall be labeled according to UL 555 and UL 555S by an NRTL.

C. Fire Rating: 1-1/2 or 3 hours.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

F. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

G. Smoke Detector: Integral, factory wired for single-point connection.

H. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

I. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

J. Leakage: Class I.

K. Rated pressure and velocity to exceed design airflow conditions.

L. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.

M. Master control panel for use in dynamic smoke-management systems.

N. Damper Motors: Modulating and two-position action.

O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf .

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.

6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf .

7. Electrical Connection: 115 V, single phase, 60 Hz.

3.8 FLANGE CONNECTORS

A. 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:

1. Ductmate Industries, Inc.

2. Nexus PDQ; Division of Shilco Holdings Inc.

3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

3.9 TURNING VANES

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

1. Ductmate Industries, Inc.

2. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

3.10 DUCT-MOUNTED ACCESS DOORS

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

1. Ductmate Industries, Inc.

2. Greenheck Fan Corporation.

3. Pottorff; a division of PCI Industries, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.

b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

c. Vision panel.

d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.

d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

3.11 FLEXIBLE CONNECTORS

A. 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:

1. Ductmate Industries, Inc.

2. Duro Dyne Inc.

3. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. .

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. .

2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.

3. Service Temperature: Minus 50 to plus 250 deg. F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd.

2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.

3. Service Temperature: Minus 67 to plus 500 deg. F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd.

2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.

3. Service Temperature: Minus 67 to plus 500 deg. F.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.

2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

3.12 FLEXIBLE DUCTS

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

1. Casco Silentflex II.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.

2. Maximum Air Velocity: 4000 fpm.

3. Temperature Range: Minus 20 to plus 175 deg F.

4. Insulation R-Value: Comply with Title 24.

3.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

3.14 DUCT SILENCER

A. Manufacturers:

1. Industrial Acoustics Company (IAC)

2. Commercial Acoustics.

3. Vibro-Acoustics.

B. General Description: Factory-fabricated and -tested, round or rectangular silencers with performance characteristics and physical requirements as indicated.

C. Fire Performance: Adhesives, sealants, packing materials, and accessory materials shall have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84.

D. Rectangular Units: Fabricate casings with a minimum of 0.034-inch- thick, solid

galvanized sheet metal for outer casing and 0.022-inch- thick, ASTM A 653/A 653M, G60, perforated galvanized sheet metal for inner casing.

E. Round Units:

1. Outer Casings:

a. ASTM A 653/A 653M, G60, galvanized sheet steel.

b. Up to 24 Inches in Diameter: 0.034 inch thick.

c. 26 through 40 Inches in Diameter: 0.040 inch thick.

d. 42 through 52 Inches in Diameter: 0.052 inch thick.

e. 54 through 60 Inches in Diameter: 0.064 inch thick.

f. Casings fabricated of spiral lock-seam duct may be one size thinner than that indicated.

2. Interior Casing, Partitions, and Baffles:

a. ASTM A 653/A 653M, G60, galvanized sheet steel.

b. At least 0.034 inch thick and designed for minimum aerodynamic losses.

F. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.

G. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.

1. Erosion Barrier: Polymer bag enclosing fill and heat-sealed before assembly.

H. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.

1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.

2. Lock form and seal or continuously weld joints.

3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.

4. Reinforcement: Cross or trapeze angles for rigid suspension.

I. Source Quality Control:

1. Acoustic Performance: Test according to ASTM E 477.

2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 2000-fpm face velocity.

3. Leak Test: Test units for airtightness at 200 percent of associated fan static

pressure or 6-inch wg static pressure, whichever is greater.

3.15 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Connect ducts to duct silencers with flexible duct connectors.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.

2. Downstream from duct filters.

3. At outdoor-air intakes and mixed-air plenums.

4. At drain pans and seals.

5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

7. At each change in direction and at maximum 50-foot spacing.
8. Downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts directly or with maximum 84-inch lengths of flexible duct. Do not use flexible ducts to change directions.

P. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

Q. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

R. Install duct test holes where required for testing and balancing purposes.

S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

T. All equipment and components requiring access above hardlid ceiling shall be provided with adequate service clearance and ceiling access panels. Coordinate ceiling access panel location based upon installation location in field and in accordance with Section 08 31 00 – Access Doors and Panels.

3.16 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.

3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation.

5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof mounted ventilators.

2. Ceiling mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.

2. Certified fan sound-power ratings.

3. Motor ratings and electrical characteristics, plus motor and electrical accessories.

4. Material thickness and finishes, including color charts.

5. Dampers, including housings, linkages, and operators.

6. Roof curbs.

7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

D. Fan shall be manufactured at an ISO 9001 certified facility.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 ROOF MOUNTED VENTILATORS

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

1. Greenheck Fan Corporation.

2. Loren Cook Company.

3. Twin City

B. Description: Fan shall be a spun-aluminum, dome top, roof mounted, belt driven, downblast centrifugal exhaust ventilator construction: The aluminum base shall have a one-piece inlet spinning and continuously welded curb cap corners for maximum leak protection. The wind band shall have a rolled bead for added strength.

C. Wheels: Aluminum hub and wheel with backward inclined blades.

2.2 CEILING-MOUNTED VENTILATORS

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

B. Greenheck Fan Corporation.

1. Loren Cook Company.

2. Twin City

C. These units are factory assembled with one or more centrifugal wheels up to 12 inches wide, directly connected to motor, enclosed in housing, with inlet grille and integral backdraft damper; AMCA rated.

D. Housing: Steel, lined with acoustical insulation.

E. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

F. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

G. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

H. Accessories:

I. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

1. Manufacturer's standard roof cap, curb, and transition fittings.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Connect wiring and ground equipment according to Division 26.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust belt tension.

6. Adjust damper linkages for proper damper operation.

7. Verify lubrication for bearings and other moving parts.

8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

10. Shut unit down and reconnect automatic temperature-control operators.

11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and Division 01 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Section 23 33 00 – Air Duct Accessories

1.2 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers.

2. Perforated diffusers.

3. Louver face diffusers.

4. Adjustable bar registers and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.

2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

5. Duct access panels.

E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

A. Adjustable Sidewall Supply:

1. Product: Titus 300RS

2. Manufacturers:

a. Anemostat; a Mestek Company.

b. Price Industries.

c. Titus.

3. Steel supply grilles shall be of the sizes and mounting types shown on the plans and outlet schedule. The deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1-1/4 inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corner shall be welded with full penetration resistance welds.

4. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on 3/4-inch centers. Blades shall have steel friction pivots on both ends to allow individual blade adjustment without loosening or rattling. Plastic blade pivots are not acceptable.

5. Optional opposed-blade volume damper shall be constructed of heavy gauge steel. Damper must be operable from the face of the grille. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water

Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

6. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

B. Adjustable Sidewall Return and Exhaust Register:

1. Product: Titus 350RL

2. Manufacturers:

a. Anemostat; a Mestek Company.

b. Price Industries.

c. Titus.

3. The fixed deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1-1/4-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

4. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°.

5. Optional opposed-blade volume damper shall be constructed of heavy gauge steel. Damper must be operable from the face of the grille.

6. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

7. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2.3 CEILING DIFFUSER OUTLETS & INLETS

A. Perforated Ceiling Diffuser and Return Registers:

1. Product: Titus PCS/PAR.

2. Manufacturers:

a. Anemostat; a Mestek Company.

b. Price Industries.

c. Titus.

3. Diffusers shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be steel or aluminum according to the model selected. The back pan shall be heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule. The diffuser neck shall have at least 1 inch depth for easy duct connection.

4. Provide 24” x 24” modular face size at accessible ceiling areas. Use 16” x 16” modular face size for hard ceiling application. Provide suitable mounting/border to ceiling system. Provide face accessible opposed blade damper for all diffusers located in hard ceiling.

5. Individually adjustable curved deflectors shall be mounted in the neck of the diffuser and must allow the discharged air to enter the room in either vertical or one-, two-, three-, four-way horizontal jets. The perforated face must be easily unlatchable from the back pan to facilitate opening of the face for pattern controller adjustment or to access an optional damper.

6. The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H.

7. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

8. Optional damper shall be constructed of heavy gauge steel. Damper must be operable from the face of the diffuser by unlatching the diffuser face. The diffuser must be designed such that complete removal of the face is not required during damper adjustment. Optional volume damper shall be provided at hard ceiling application.

9. The manufacturer shall provide published performance data for the perforated diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 26 00 00

GENERAL ELECTRICAL SPECIFICATIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical/Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.

1. Work Included: Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.

2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.

B. Electrical Drawings: Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

1.2 QUALITY ASSURANCE

A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:

1. Institute of Electrical and Electronic Engineers - IEEE

2. National Electrical Manufacturers' Association - NEMA

3. Underwriters' Laboratories, Inc. - UL

4. National Fire Protection Association - NFPA

5. Federal Specifications - Fed. Spec.

6. American Society for Testing and Materials - ASTM

7. American National Standards Institute - ANSI

8. National Electrical Code - NEC

9. National Electrical Safety Code - NESC

10. Insulated Cable Engineers Association - ICEA

11. American Institute of Steel Construction - AISC

12. State and Municipal Codes In Force In The Specific Project Area

13. Occupational Safety and Health Administration (OSHA)

14. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)

15. California Electrical Code (where adopted)

16. Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes

B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.

1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.

2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

1.3 GENERAL REQUIREMENTS

A. Guarantee: Furnish a written guarantee for a period of (1) one-year from date of acceptance.

B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.

C. All Core Cutting, Drilling, and Patching:

1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.

2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer.

3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.

4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.

5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

D. Verifying Drawings and Job Conditions:

1. The Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.

2. The Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

1.4 WORK IN COOPERATION WITH OTHER TRADES

A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical 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 conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.

B. Provide a conduit-only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits, and backboxes required for installing conductors to the controls.

C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

1.5 TESTING AND ADJUSTMENT

A. Upon completion of all electrical work, the Contractor shall test all circuits, switches, light fixtures, lighting control and dimming systems including distributed systems, UPSs, generators, SPDs, lighting inverters, transfer switches, motors, circuit

breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.

B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.

C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.

D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

1.6 IDENTIFICATION

A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, fire alarm/central monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal and control cabinets.

1. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications. Nameplates shall be engraved with the device designation/identification on the top line, source identification for the device on the 2nd line per NEC, or CEC where adopted, Art 408.4 and load designation for the device on the bottom line. Where load designation consists of a branch circuit, omit bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.

   Example: Transformer 1TA

   Source Disconnecting Location: Switchboard MSA located in Rm 110

   Load: Panels 1LA and 1 LB

2. All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU sub-feed circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.

B. Identification nameplates, UON, shall be laminated/extruded modified acrylic that is 3/32" thick, UV-stabilized, matte finish, suitable for use in 180 deg. F ambient, with beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background (utility/normal and optional standby power systems) for single line of text. Where two lines of text are required, provide minimum 2" high nameplate. Where three lines of text are required, provide minimum 2.5" high nameplate. Provide white

letters on red background for all NEC, or CEC where adopted, Article 517 essential power systems, Article 700 Emergency Systems, Article 701 Legally required standby systems and Article 708 COPS.

C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards and motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.

D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU sub-feed circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV-resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.

E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or instruction placards, as required for all kirk-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be engraved 1/2" high white lettering on a red background using the same material specified for identification nameplates with a self-adhesive backing. Warning/instruction placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any warning/instruction placards. In all cases, clean surfaces before applying warning/instruction placards parallel to equipment lines.

F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telecom/data/AV racks and cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 3/32" thick Micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.

G. See wiring device section of this specification for wiring device plate cover labeling requirements.

H. See drawings for panel board schedule directory installation requirements.

I. See conduit installation section of this specification for conduit labeling requirements.

1.7 FINAL INSPECTION AND ACCEPTANCE

A. After all requirements of the Specifications and/or the Drawings have been fully completed; representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.

B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.8 RECORD DRAWINGS

A. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOW EQUAL

A. Approvals: Where the words (or similar terms) “approved”, “approval”, “acceptable”, and “acceptance” are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.

B. Equal: Where the words (or similar terms) “equal”, “approved equal”, “equal to”, “or equal by”, “or equal” and “equivalent” are used, it shall be understood that these words are followed by the expression “in the opinion of the Owner, Architect, and Engineer.” For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance/style (includes craftsmanship, physical attributes, color and finish), and the same performance.

C. Substitution: For the purposes of specifying products, “substitution” shall refer to the submittal of a product not explicitly approved by the construction documents/ specifications.

1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples, if requested, must be included in the submittal. ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.

2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers/distributors of both the specified and proposed equal material for price comparison, as well as a verification of delivery dates that conform to the project schedule.

3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.

4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.

D. Alternates/Alternatives: For the purposes of specifying products, "alternatives/alternates" may be established to enable the Owner/Architect/Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.

E. No Known Equal: For the purposes of specifying products, "No Known Equal" shall mean that the Owner/Architect/Engineer is not aware of an equivalent product. The Contractor will need to submit a "Substitution" item, per the requirements listed above, if a different product is proposed to be utilized.

1.10 SHOP DRAWINGS/SUBMITTALS

A. Shop Drawings/Submittals, unless required otherwise by general project specifications or instructions to bidders, shall be submitted in electronic format (PDF) to include a Letter of Transmittal (PDF), which shall give a list of the drawings submitted with dates and/or system(s) components contained within the submittal. Drawings and material cut sheets shall be complete in every respect and edited/marked to indicate specific items being provided. Printed/Hard copies are not acceptable.

B. The Shop Drawings/Submittals shall be marked with the name of the project, numbered consecutively, and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.

C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor's letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.

D. Only products listed as "Equal" within the contract documents, along with formally approved "Substitutions" will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.

E. Review comments used in response to shop drawings/submittals are:

1. "No Exception Taken" - Product approved as submitted.

2. "Furnish as Corrected" - Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.

3. "Revise and Resubmit" - Re-submittal required with corrections as noted.

4. "Rejected" - Re-submittal required based upon the originally specified product.

F. Shop drawings shall be submitted on the following but not limited to:

1. Lighting Fixtures, Lamps, and Ballasts.

2. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information.

3. Transformers.

4. Fire Alarm System/Central Monitoring System.

5. Wiring Devices.

6. Lighting Control System/Dimming System Products.

7. Pullboxes and Underground Vaults.

8. Terminal Cabinets

9. Lighting Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches, SPD Systems.

10. Cable Tray, Flexible Cable Tray and Cable Runway.

11. Power Poles and Floor Boxes.

12. Arc Flash, Short-Circuit and Coordination studies.

13. All other products called out on drawings that call for shop drawing submittal.

1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS

A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating, maintenance, and servicing instructions, as well as four (4) complete wiring diagrams for the following, but not limited to, items or equipment:

1. Lighting Control System/Dimming Systems.

2. Fire Alarm System.

3. Transformers.

4. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information

5. Lighting Inverters, UPS's, PDUs, Generators, Transfer Switches, SPD Systems

B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

1.12 INTERRUPTION OF SERVICE/SERVICE SHUTDOWN

A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work, shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.

B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.

C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ)

B. Switchgear/Switchboards/Distribution Boards/Motor Control Centers:

1. See general single line notes on single line drawing for more information.

C. Panel boards – Branch Circuit:

1. See drawings for panel board schedules and specifications.

D. Transformers:

1. See drawings for transformer schedules and specifications.

E. Lighting Fixtures:

1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.

2. Ballasts: See lighting fixture schedule notes. All noisy ballasts shall be replaced at no cost to the Owner.

3. Lamps: See lamp/fixture schedule and lamp/lighting fixture schedule notes.

F. Wiring Devices:

1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process

   a. Wiring Devices (Decora)

      1) Convenience Receptacle #16252- ???

      2) Dedicated Receptacle #16352-???

      3) Convenience I.G. Receptacle #16262-IG-???

      4) Dedicated I.G. Receptacle #16362-IG-???

      5) Convenience G.F.C.I. Receptacle #GFT1-???

      6) Dedicated G.F.C.I. Receptacle #GFNT2-???

      7) Convenience Hospital Grade Receptacle #16252-HG?-???

      8) Dedicated Hospital Grade Receptacle #16352-HG?-???

      9) Convenience G.F.C.I. Hospital Grade #GFNT1-HG?

      10) Dedicated G.F.C.I. Hospital Grade #GFNT2-HG?

      11) Tamper Resistant Convenience Receptacle #TDR15-???

      12) Tamper Resistant Dedicated Receptacle #TDR20-???

      13) Tamper Resistant GFCI Receptacle #GFTR2-???

      14) Tamper Resistant. Convenience. G.F.C.I. Hospital

      15) Grade Receptacle #GFTR1-HG?

      16) Tamper Resistant. Dedicated. G.F.C.I. Hospital

      17) Grade Receptacle #GFTR2-HG?

      18) Weather/Tamper Resistant GFCI Receptacle #GFWT2-???

      19) Convenience Simplex Receptacle #16251-???

      20) Dedicated Simplex Receptacle #16351-???

      21) Recessed Clock Receptacle #5361-CH-???(Non-Decora)

22) Single Pole Switch #5621-2-???

23) Double Pole Switch #5622-2-???

24) Three Way Switch #5623-2-???

25) Four Way Switch #5624-2-???

26) Pilot Light Switch "On" #5628-2-???

27) Pilot Light Switch "Off" #5631-2-???

28) Projection Screen Switch #5657-2-???

29) Low Voltage Momentary Switch #5657-2-???

30) Keyed Switch #1221-2L-???(Non-Decora)

31) Door Jam Switch #1865-???

b. Use of dedicated receptacles is required where plans depict a branch circuit supplying only a single simplex or duplex receptacle. Use of controlled receptacles is required where depicted on plans - see controlled receptacle specifications for additional information.

2. I.G. (isolated ground) receptacle bodies shall be of a basic color specified above with an orange triangle to symbolize isolated ground.

3. H.G. (hospital grade) receptacle bodies shall be of a basic color specified above with a green circle to symbolize hospital grade.

4. When shown circuited with an I.G. conductor, receptacles shall be of an I.G. type. As an example, a NEMA L6-30R denoted on the plans and shown circuited with an I.G. conductor shall be an I.G. version of that receptacle.

5. Wiring devices located in wood finished areas shall generally be black unless otherwise indicated by the Architect.

6. Wiring devices located in mirrors shall generally be white with stainless steel cover plates unless otherwise indicated by the Architect.

7. In addition to other device requirements listed elsewhere in this specification and NEC, or CEC where adopted, Articles 406.12 & 517.18, all 125V & 250V, 15A and 20A, non-locking receptacles shall be Tamper-Resistant when located in the following locations:

a. In dwelling units per NEC, or CEC where adopted, Article 210.52.

b. In guest rooms and guest suites of hotels and motels.

c. In child care or daycare facilities.

d. In preschool and elementary education facilities.

e. In business offices, corridors, waiting rooms, and the like in clinics, medical and dental offices and outpatient facilities.

f. In a subset of Assembly Areas outlined in NEC, or CEC where adopted, Article 518.2 including transportation waiting areas, gymnasiums, skating rinks, and auditoriums.

g. In dormitories.

h. In pediatric care areas per NEC, or CEC where adopted, Article 517.18(C).

8. Wiring device cover plates located on recessed boxes shall be commercial grade nylon. Plate color shall match wiring device color UON on plans. Cover plates utilized on surface mounted boxes shall be metal. Plastic cover plates are unacceptable.

9. Except as otherwise noted, all wiring device plates on the project shall be labeled with panel and circuit number(s) utilizing a Brother P-Touch labeling system with 1/2" tape (yellow on black) or equal by Herman-Tellerman or Panduit. Locate label on the concealed side of the wiring device plate. Handwritten labels are unacceptable.

10. The Contractor shall provide duplex receptacle outlets in the appropriate configurations necessary to comply with applicable energy code requirements for controlled receptacles and as shown on plans. All wiring devices indicated to be controlled receptacles shall be NEMA-approved, electrical code-compliant with factory markings on the face of the receptacle(s) with the word "Controlled" or utilize further markings and symbols to indicate which receptacles on each outlet is/are controlled. Stickers, field-applied markings or other non-permanent markings are not acceptable. Where a GFCI receptacle outlet is required to be controlled, provide an adjacent controlled duplex receptacle outlet connected on the load side of the GFCI outlet. Generally, one receptacle in a duplex receptacle outlet is required to be controlled. It may be the lower receptacle or upper receptacle based on manufacturer offering. However, the controlled receptacle location within a controlled receptacle outlet shall remain consistent throughout the project. Where an existing duplex receptacle outlet is required to be controlled, provide a new wiring device with the appropriate control configuration necessary to comply with plans. All controlled receptacles shall be connected to a branch circuit controlled by an occupancy sensor-based or relay panel lighting control system. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell.

11. The following wiring device plates shall have custom engraving:

a. Key operated switches, switches with pilot lights, and switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate indicating the motor, heater, or ventilator controlled.

b. Receptacles on optional standby generator and/or UPS power shall have custom engraved plates with the words "Generator" or "UPS" in black letters. In addition, where located in telecommunications closets, IDFs, server

rooms, data centers, labs (wet, dry or electronic) indicate panel board and circuit number.

c. For Health Care Facilities, provide custom engraved device cover plates, for all devices, indicating panel board and circuit number. Devices served by normal/utility power circuits shall have black lettering. Devices served by essential electrical system power circuits shall have red lettering.

d. All stainless steel and nylon device plates shall be engraved using a rotary engraving process except for black lettering on stainless steel device plates which may be accomplished via laser etching process. All lettering shall be 3/16" high. Provide a dimensioned submittal drawing detailing a typical device faceplate with engraving.

G. Weatherproof Outlet Covers/Assemblies: All Receptacles identified as weatherproof on the drawings shall be weather-resistant, tamper-resistant, GFCI type and equipped as follows:

1. Type WP-A: Recessed wall box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed rain tight while "in use". Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation of power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:

a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.

b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.

c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box. Where shown mounted in a building wall, any blank/unused compartment shall be equipped min. 3/4" C.O. with pull string routed to the nearest accessible ceiling space.

d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.

e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.

f. Custom color powder coat finish as selected by Architect - Include all costs in base bid for same.

g. In locations with sufficient wall depth, provide 6" wide x 6" tall x 5-1/2" deep recessed wall box (C.W. Cole #TL310-WCS-K1-CUSTOM COLOR).

h. In locations utilizing shallow stud walls construction or other walls of insufficient depth, provide 10-3/4" wide x 7-3/8" tall x 3-7/8" deep recessed wall box (C.W. Cole #TL310-WCS-SH-K1 -CUSTOM COLOR).

i. See drawings for additional details.

2. Type/Subscript WP-B: Wet location-listed raintight while "in use" cast copper-free aluminum, extra-duty, lockable cover with baked aluminum lacquer finish and one gang, weather-resistant, tamper-resistant GFCI receptacle. Hubbell WP26E series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). Contractor shall powder coat cover assembly to a custom color where receptacle locations are deemed by the Architect to be in aesthetically sensitive or public spaces. Custom color as selected by Architect.

3. Type WP-C: (C.W. Cole #TL310-WCS-PED-ADA-K1-CUSTOM COLOR or #TL310-WCS-PED-K1-CUSTOM COLOR) pedestal device box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while "in use". Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:

   a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.

   b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.

   c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box.

   d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.

   e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.

   f. Include all costs in base bid for ADA & 2022 CBC accessibility version (22.5" tall) of pedestal box. Prior to ordering material, contractor shall coordinate with Architect and/or AHJ to determine which pedestal box locations do not require ADA & 2022 CBC accessibility compliance and may be changed to the standard (11.5" tall) version of the pedestal box.

   g. Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.

   h. See drawings for additional details.

4. Type/Subscript WP-D: Damp location-listed (not-Raintite-in-use) cast copper-free, pad lockable, die-cast aluminum cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell/Rayco 502?/503? Series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC where adopted, article 406.9(A) and (B). Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.

H. Motor Controllers/Starters: See drawings for motorized equipment schedules and specifications.

I. Circuit Breakers:

1. Service entrance circuit breakers smaller than 400A (Amp) frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers and main circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification.

2. All non-service entrance circuit breakers 225A and larger shall be thermal magnetic type and have continuously adjustable instantaneous pick-ups of approximately 5 to 10 times trip rating. Breakers shall have either tamper-resistant rating dials or easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600A frame and larger, located in 480V, 3-phase, 3-wire or 277/480V, 3-phase, 4-wire switchgear, distribution boards, panel boards or busway plugs shall be solid state, 100% rated. Breaker shall have built-in test points for testing long delay, short delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above - at the Engineer's request.

3. All non-service entrance circuit breakers less than 225A shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.

4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a UL listed current limiting thermal magnetic circuit breaker(s) UON. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.

5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating, Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and

instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above, at the Engineer's request.

6. Circuit breakers, 1200A Frame or larger, or circuit breakers with sensors or adjustable trip settings, 1200A or larger, shall be equipped with an Energy Reducing Maintenance Switch that complies with NEC, or CEC where adopted, 240.87 (B) (3) unless specified elsewhere with an alternate arc energy reduction method allowed by this same code section.

7. Ground Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with ground fault circuit interrupt capability, conforming to UL Class A, Group 1.

8. Arc Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with arc fault circuit interrupt capability, conforming to UL 1699. Provide on all dwelling-unit circuits supplying bedrooms, sleeping quarters etc. as required to comply with NEC, or CEC where adopted, Article 210.12.

9. Tandem or half-sized circuit breakers are not permitted.

10. Series-Rated Breakers: UL listed series-rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series-rated breakers are used, switchboards, distribution boards, and panel boards shall be appropriately labeled to indicate the use of series-rated breakers. Shop drawing submittal shall include chart of UL listed devices, which coordinate to provide series rating.

11. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 100A.

12. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.

13. Shunt-trip equipped circuit breakers shall be provided on all elevator feeders.

14. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to due nearby industrial processes, etc.

15. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.

16. All circuit breaker terminations shall be suitable for use with 75-degree Celsius ampacity conductors. Listed, dual-rated pin terminals, straight or offset, are acceptable for use to in accommodating oversized or parallel conductor installations.

17. Circuit breakers serving Fire Alarm or Central Monitoring panels and power supplies shall be red in color and lockable in the "ON" position.

J. Disconnect Switches:

1. Non-fusible or fusible, heavy-duty, externally-operated horsepower-rated, 600V A.C: Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.

2. Fusible switches shall be Class “R” when 600A or less or Class “L” when greater than 600A.

3. Amperage, Horsepower, Voltage and number of poles per drawings: All shall be clearly marked on the switch nameplate.

4. Provide the Owner’s project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

K. Fuses:

1. Provide fuses at all locations shown on the Drawings and as required for supplemental protection:

   a. Fuses shall be manufactured by Bussman, Shawmut, or equal.

   b. All fuses shall be the product of a single manufacturer.

2. Main and Feeder Protection:

   a. Protective devices rated greater than 600A: Provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.

   b. Protective devices rated 600A or less: Provide Bussman Class R fuses, Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.

3. Motor Protection:

   a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.

   b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.

   c. Where fuses feeding motors are indicated, but not sized, it shall be the responsibility of the Contractor to coordinate the fuse size with the motor to provide proper motor running protection.

   d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.

L. Cable Tray, Flexible Cable Tray and/or Cable Runway:

1. See drawings for Cable Tray, Flexible Cable Tray and/or Cable Runway specifications.

M. Uninterruptible Power Systems (UPS):

1. See drawings for UPS schedules and specifications.

N. Power Distribution Units (PDU):

1. See drawings for PDU schedules and specifications.

O. Generator Systems:

1. See drawings for Generator schedules and specifications.

P. Transfer Switches:

1. See drawings for Transfer Switch schedules and specifications.

Q. Lighting Control/Dimming Systems:

1. See drawings for Lighting Control and/or Dimming Systems schedules and specifications.

2. Wall box dimmers shall be rocker-type as manufactured by Lutron (no known equal except as noted below). Dimmers and dimmer faceplates shall match the color of adjacent switches and faceplates. Dimmers and dimmer faceplates in wood finished areas shall generally be black unless otherwise indicated by the Architect. The Contractor shall obtain written approval of the Architect regarding final dimmer and dimmer faceplate color selection prior to ordering material. Multiple dimmers/switches shall be ganged together with a common cover plate. Provide dimmers as follows:

a. Incandescent: Lutron DIVA DV-10P or DV-103P (3-way) (1000-Watt max.).

b. Electronic Low Voltage: Lutron DIVA DVELV-300P or DVELV-303P- (3-way) (300 Watt).

c. Magnetic Low Voltage: Lutron DIVA DVLV-10P or DVLV103p (3-way) (800-Watt max.).

d. Fluorescent (3-Wire): Lutron DIVA DVF-103P (single/3way, 8A @ 120V) or DVF-103P-277 (single/3way, 6A @ 277V).

e. Fluorescent (0-10V): Lutron DIVA DVTV with PP-???H Power Pack.

f. Fluorescent (Lutron Tu-Wire): Lutron DIVA DVFTU-5A3P with Lutron H.P. module where required.

g. LED (0 - 10V): Lutron DIVA DVTV with PP-???H Power Pack.

h. Screw Base CFL/LED: Lutron DIVA DVCL-153P.

i. Fan Control: Lutron DIVA DVFSQ-F (1.5A @ 120V max, 3 speed, single pole, 3-way).

3. Contractor shall verify if dimmer(s) requires derating when ganged. Contractor shall provide, and provide connections to, additional Lutron Power Modules, Lutron Power Packs, and / or Lutron Interface Modules where required to accommodate loads higher than dimmers standard or derated load-carrying capacity. Note - contractor may to provide a Lutron recommended dimmer type (typically a #DVF-103P unit) to control the necessary power modules or interface devices.

R. Fire Alarm System/Central Monitoring System:

1. See drawings for Fire Alarm System or Central Monitoring System specifications.

S. Surge Protective Device (SPD):

1. See drawings for SPD specifications.

T. Conduit:

1. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metalizing, or sherardizing process.

2. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242, and meet Federal Specification WWC-581 (latest revision).

3. Electrical Metallic Tubing (EMT) shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces. EMT shall be dipped in a chromic acid bath to chemically form a corrosion-resistant protective coating of zinc chromate over galvanized surface.

4. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Use only as directed in writing by the Engineer with the exception of 400 Hz feeders and 400 Hz branch circuits which shall be run in flexible aluminum conduit.

5. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory-installed fittings. For outdoor installations and motor connections only unless otherwise noted on drawings.

6. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc.) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.

7. When approved for use in the Allowed Specification Deviations Section, generally located on the symbols list drawing, MC cables shall be allowed for lighting branch circuits (homeruns shall be EMT), receptacle branch circuits (homeruns shall be EMT) and poke-thru fed systems furniture homeruns. MC shall not be used where exposed, except for a maximum 6' length for final connections to light fixtures, or terminate in electrical panelboards or distribution boards. Equipment ground conductor shall be green. Isolated ground conductor shall be green with yellow stripe. Provide 600V rated aluminum or lightweight steel interlocking armor Metal Clad (MC) cable with copper conductors, THHN (90-degree C) insulation, and integral equipment grounding conductor and isolated grounding conductor as required. Type AC cable listed for use in patient care areas for non-essential electrical system branch circuits per NEC or CEC where adopted, Article 517.13 shall be required in such areas in lieu of MC cable. Type AC and MC cable shall not be used for essential electrical system branch circuits. MC cable shall be manufactured to Underwriter Laboratory Standard 1569. See PART 3 - EXECUTION section of this specification for additional installation requirements.

8. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See PART 3 - EXECUTION section in this specification for additional installation requirements.

9. Non-Metallic Conduit:

    a. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (UL) requirements, listed for exposed and direct burial application.

    b. Conduit and fittings shall be produced by the same manufacturer.

10. Fire-rated MC Cable:

    a. 2-hour fire-rated, polymer insulated 600V MC cable listed and conforming to Underwriters Laboratories, Inc. (UL) 2196 and UL 1569 requirements for installation as an Electrical Circuit Protective System for use in complying with NEC, or CEC where adopted, Articles 695 and 700. Where adopted, cable sheath shall be suitable for use as a NEC or CEC equipment grounding conductor, and shall be listed for use in wet locations to 90 degrees C (Raychem or equal).

    b. Cable connectors shall be brass MC connectors.

U. Fittings:

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system.

These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.

2. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.

3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.

4. UON all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2” and smaller. Insulated throat is not required for fittings, connectors and couplings 1” and smaller.

5. All interior and exterior EMT fittings, connectors and couplings, 2” and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be Raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If Raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.

6. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.

7. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

V. 600 Volt Conductors - Wire and Cable:

1. All conductors shall be copper. Provide stranded conductor for #10 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.

2. Type THHN/THWN-2 thermoplastic, 600 volt, UL approved, dry and wet locations rated at 90 degrees Celsius, for conductors of all sizes from #12 AWG up to and including 1000 kcmil. RHH/RHW insulation is allowed only to provide an Electrical Circuit Protective System to comply with NEC, or CEC where adopted, Articles 695 and 700.

3. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.

4. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.

5. Systems Conductor Color Coding:

    a. Power 208/120V, 3PH, 4W:

        1) Phase A = Black

        2) Phase B = Red

        3) Phase C = Blue

        4) Neutral = White or White with Phase Color Tracer

        5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).

        6) Travelers = Purple with Black stripe or Pink.

    b. Power 480/277V, 3PH, 4W:

        1) Phase A = Brown

        2) Phase B = Orange

        3) Phase C = Yellow

        4) Neutral = Grey or Grey with Phase Color Tracer

        5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).

        6) Travelers = Purple with black stripe or Pink..

    c. Ground Conductors: Green

    d. Isolated Ground Conductors: Green with continuous yellow stripe.

    e. Fire Alarm System: As recommended by the manufacturer.

6. All color-coding for #12 through #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.

7. No conductors carrying 120V or more shall be smaller than #12 AWG.

8. Aluminum conductors shall not be used.

9. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.

W. Medium Voltage Conductors (greater than 600V):

1. See drawings for Medium Voltage Cable Schedule and Specifications.

X. Junction and Pullboxes:

Y. For interior dry locations, boxes shall be NEMA 1 galvanized one-piece drawn steel, knockout type, with removable, machine screw secured covers.

1. For outside, damp or surface locations, boxes shall be NEMA 3R heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.

2. For in-grade applications, junction and pull boxes shall be pre-cast concrete or molded fiberglass manufactured by Christy, Brooks-Jensen, or Utility Vault Co. Fiberglass boxes shall:

a. Be used only in landscape planter areas that are not subject to damage from lawnmowers, tractors and other machinery.

b. Not be used in lawn or turf areas.

c. Not exceed 11” W x 17” L in size unless required to be larger to meet code requirements.

3. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required.

4. All boxes located in traffic areas shall be traffic rated.

Z. Outlet Boxes:

1. For fixtures, boxes shall be galvanized, one-piece drawn steel, knockout type equipped with 3/8" fixture studs and plaster rings where required.

2. For convenience outlets, wall switches, or other devices, outlet boxes shall be galvanized one-piece drawn steel, knockout type 4" x 4"x 2-1/8" minimum size with plaster rings as required.

3. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements, and submitted for approval.

4. For exposure to weather, damp locations, or surface mounting, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs; covers shall be watertight with gaskets and non-ferrous screws.

5. Outlet boxes used for support of ceiling fans shall be galvanized, one-piece drawn steel, knockout type equipped with bracing bars and plaster rings where required and listed for ceiling fan support use. Such boxes shall be labeled and capable of supporting ceiling fan weights up to 70 pounds.

6. See drawings for floor box installation notes and specifications.

AA. Plywood Backboards: Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' all (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.

BB. Terminal Cabinets:

1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.

2. Provide each terminal cabinet with a full size mounting backplate.

3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.

4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.

5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc.). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.

CC. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surfaces. Refer to painting section of the specifications for additional requirements.

DD. Seismic Design, Certification and Anchoring of Electrical Equipment:

1. Contractor shall include all costs in the base bid for labor, materials, all special inspections and structural engineering design necessary to meet the Seismic Design Requirements for Non-structural Components (Chapter 13, ACE SEI 7-05 Minimum Design loads for Buildings and Other Structures) as required by IBC, or CBC where adopted, Section 1708 and as related to the installation all electrical equipment furnished under this contract. See Specific Project Site Seismic Criteria on architectural and/or structural plans which include Building Occupancy Category, Seismic Design Category, Design Spectral Response Acceleration (S_{DS}), Height factor ratio (z/h) and Site Class. Non-structural Component Importance Factor (I_P) for a particular component shall be determined based on the following criteria:

   a. I_P = 1.0: Non-life safety, Non-structural Components in an Occupancy Category IV Facility not required for continued operations of the facility or in

any other Occupancy Category Facility where component failure will not impair continued operation of the facility.

b. IP=1.5: Designated Seismic Systems are those non-structural components in any Occupancy Category IV facility (except as noted above) or that are a part of any code-defined Critical, Life Safety, Emergency and Legally Required Standby Electrical System. Additionally, those non-structural components containing hazardous materials shall be classified as Designated Seismic Systems. While Designated Seismic Systems are generally identified on the plans, they may include items such as generators, automatic transfer switches, UPS units and all associated electrical distribution equipment and components necessary for the designated seismic system to form a complete and operable system. The Contractor shall ultimately be responsible for identifying Designated Seismic Systems. For any electrical component either identified on the plans or determined by the contractor to be a Designated Seismic System, all line and load side electrical distribution systems supporting that Designated Seismic System (including, but not limited to, feeders, panel boards switchboards, transformers, all related component supports and attachments etc.) shall be considered a part of the designated seismic system for the purposes of code-compliance and seismic certification.

c. z/h - Height factor ratio: See plans for respective equipment locations.

2. Provide a delegated-design submittal for each of the following seismic-restraint systems to be used as required:

a. Restraint Channel Bracings consisting of MFMA-4, shop-or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

b. Restraint Cables consisting of ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service, with a minimum of two clamping bolts for cable engagement.

c. Seismic-Restraint Accessories consisting of hanger rod/hanger rod stiffener assemblies, multifunctional steel connectors for attaching hangers to rigid channel bracings and/or restraint cables, bushings for floor and wall-mounted equipment anchor bolts and resilient isolation washers and bushings.

d. Mechanical Anchor Bolts consisting of 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.

e. Adhesive Anchor Bolts consisting of drilled-in and capsule anchor system containing resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide specific LEED-compatible environmentally-friendly resins

and adhesives on all LEED projects. 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.

3. Submittal shall include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the contractor's structural engineer responsible for their preparation. Calculations shall include, but not be limited to, static and dynamic loading caused by equipment weight, operation, and seismic and, if applicable, wind forces required to select seismic and, if applicable, wind restraints and for designing vibration isolation bases. Provide seismic and wind-restraint detailing to support system selection, arrangement of restraints, attachment locations, methods, and spacings with all components identified to include their strengths, directions and values of forces transmitted to the structure during seismic events and association with vibration isolation devices. Sizes of components shall be selected so strength will be adequate to carry present static and seismic loads to accommodate 25% spare future capacity within specified loading limits.

4. Any pre-approval and evaluation documentation shall have a California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproval (OSP) demonstrating horizontal and vertical load testing and analysis showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. 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) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

5. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified elsewhere in the project specifications.

6. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment. Flexible connection limitations of the NEC, or CEC where adopted, shall apply.

7. Install seismic-restraint devices using methods approved by OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component.

8. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by OSHPD or an agency acceptable to authorities having jurisdiction.

9. The contractor shall engage a qualified testing agency to perform tests and inspections as listed in other Project Specifications, but as a minimum shall

include at least four of each type and size of installed anchors and fasteners selected by Architect. Schedule tests 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. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members as required. Test to 90 percent of rated proof load of device. Prepare and submit test and inspections reports.

EE. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for complete requirements.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

A. Installation of Conduit and Outlet Boxes:

1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.

2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:

   a. When noted on the drawings.

   b. When considered exposed to damage by the local AHJ.

   c. When installed in wet or damp locations and of a trade size where listed-Raintite fittings, connectors, couplings etc. are unavailable.

   d. When required by NEC or CEC Article 517.13.

   e. When installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.

3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or steel-tube EMT and in accordance with NEC, or CEC where adopted, Article 342.

4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. Except when concealed in walls or other structural elements, all flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per NEC in each

conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.

5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the NEC, or CEC where adopted, in damp and wet location, where exposed to weather, in refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of liquidtight flexible conduit shall be allowed as approved in writing by the Engineer on a case by case basis.

6. Rigid metallic conduit installed underground or embedded in concrete shall be 1” trade size minimum and shall be wrapped with 20 mil. Polyvinylchloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4" minimum trade size.

7. Where required for providing an electrical circuit protective system to comply with NEC, or CEC where adopted, Articles 695 and 700 utilize UL Listed 2-hour fire-rated, MC cable or UL Listed 2-hour fire-rated RHH/RHW conductors in conduit.

8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.

9. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.

10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.

11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.

12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.

13. PVC conduit shall not be run in walls except where approved by the Engineer prior to bid in limited instances that may include concrete or CMU walls used in site retaining, parking structures, or exterior equipment yard or enclosure walls, etc.

14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.

15. Where conduit extends through roof to equipment on roof area, the Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner’s roof warranty. This flashing shall be delivered to the roofing Contractor for installation. The actual location of all such roof penetrations and outlets shall be verified by the Architect/Owner. Contractor to verify type of flashing prior to bid and include all costs.

16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.

17. Where conduit racks are used the rack shall consist of two-piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.

18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.

19. Seismic Conduit Support:

    a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

CONDUIT SIZE	MAXIMUM SPACING
1/2" to 3"	6'-0"
3-1/2" to 4"	8'-0"

20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.

21. Open knockouts in outlet boxes only where required for inserting conduit.

22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.

23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or screwed to studs; on wood studs attachment shall be with wood screws, nails are not acceptable.

24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.

25. Junction Boxes that do not contain any device(s) shall be located in storage rooms, electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner’s Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner’s Project manager.

26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on architectural and/or structural drawings. If architectural and/or structural drawings are not provided on the project,

Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any additional requirements imposed by the local Authority-Having-Jurisdiction.

27. Sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24-gauge galvanized steel no more than 1/2" greater in diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool and waterproof below grade. When located in fire rated structures, provide UL listed fire stopping system. See fire stopping section of this specification for additional requirements.

28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device/method to keep dirt/debris from entering box, conduit or panels. If dirt/debris does get in, it shall be removed prior to pulling wires.

29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover, and painted as directed by the Architect with weatherproof paint to match building.

30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.

31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.

32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures

33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.

34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend, or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers. Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.

35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.

36. Except as otherwise indicated on the Drawings or elsewhere in these specifications, bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times the internal diameter of the conduit. Except where sweeping vertically into a building, and where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12'-6" radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.

37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16-gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.

38. The following additional requirements shall apply to underground conduits:

    a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per NEC, or CEC where adopted Article 517.13.

    b. For all communications conduits 2" and larger and feeders 100A or greater, provide with a minimum 3" inch, (2,000 LB) concrete envelope, 2-inch minimum separation between conduits, installed at depth of not less than 24" below grade. (Provide concrete encasement and/or greater minimum conduit depth as required by the Utility Companies.) Conduit separation within a duct bank shall be maintained using plastic spacers located at 5'-0" intervals. Where power and communication conduits are run in a common trench, a 12-inch minimum separation shall be maintained between power and communication conduits or as required by Utility Companies. Where concrete encasement is not required by serving utilities for a utility-only duct bank, provide free draining sand bedding suitable to achieve 95% relative compaction based on ASTM D1557 using 6" lifts or directed by Utility Company Standards.

    c. In all cases, where any conduit(s) pass under a building slab or footing, the electrical Contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation extending a minimum of 24" on either side of the foundation. In all cases, where conduit(s) pass through a sleeve in a footing or other foundation element, the electrical Contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or through the slab or footing via the trench or sleeve.

d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.

e. Underground conduits, which terminate inside building(s) below grade, such as in a basement level, or which slope so that water might flow into interior building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain membrane/system manufacturer and installer warranty for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and such that water drains into the nearest manhole, pull box or vault – not into the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) preventing both water and gas from entering the facility via the conduits.

f. Include a separate insulated green ground conductor sized per NEC, or CEC where adopted, in each underground electrical feeder/branch circuit.

g. All underground conduits with circuits rated at 40As or greater and all underground communications conduits shall be provided with a metallic marker tape located 12 inches below the finished grade.

h. Where underground conduits sweep into/through slabs, utilize PVC 90 degree sweeps that transition, via female PVC adapter to GRC coupling mounted flush in slab. GRC couplings shall be 1/2 lap taped with 20-mil tape. If the distance of the conduit run between a sweep and the next connecting sweep, pullbox, vault or manhole exceeds 150 ft then the sweep shall be concrete encased. Exceptions:

    1) Communications conduits shown terminating at a finished floor shall have an additional 4” high GRC nipple equipped with a bushing, removable conduit plug, labeling tag and pull rope. Tie off pull rope to conduit plug.

    2) Utility conduit sweeps shall be installed per the requirements of the respective utility company.

i. All PVC conduit shall be glued for a water and gas tight installation. The Contractor shall use appropriate solvent on all joints prior to gluing conduit and fittings together.

j. All underground conduit work shall conform to the Federal, State and Local Safety Orders or Rules regarding excavations, trenches and related earthwork. For projects in California, refer to the California Code of

Regulations, Title 8, Construction Code Sections 1540 and 1541 for additional requirements.

39. Installation of Metal Clad (MC) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing).

    a. Provide J-box above accessible ceiling prior to running MC cable within partitions or walls. J-box shall be permanently labeled with panel identification and circuit numbers contained within.

    b. Overhead MC cable runs shall generally follow building lines to provide a neat and workmanlike installation.

    c. Provide code-sized J-boxes to accommodate MC cable splicing in general. For systems furniture poke-through feeds utilizing MC cable, transition from MC cables to conduit and wire near the panelboard in the TI accessible ceiling space on the floor below the panel board via code-sized gutter(s). Utilize UL listed, insulated barrier strips with recessed screw heads (Ideal #89-6?? Series or equal) fastened within the gutter(s), terminate MC conductors on one side of the strips(s) and individual conductors in conduit from the panelboard(s) on the other side of the strip(s). Label each terminal strip(s) with panel designation. Label each phase conductor with circuit number using wire markers (Ideal or equal). Wire nuts are not an acceptable alternative to the terminal strips in these underfloor transition locations. Provide (1) spare 3/4” conduit from each gutter to its respective panelboard.

    d. MC cable shall not run directly into panelboards, distribution boards or electrical rooms.

    e. MC cabling shall be provided with its own code-approved ceiling support wires, cable hangers, individual spring steel support clips, steel trapeze hangers, threaded roads or dedicated #10 AWG drop wire. Cable supports shall be fastened to concrete slabs, beams, joists or other structural members of the building. In no case shall MC cable rest on ceilings, suspended ceilings or structures. Do not support MC cable using ceiling support wires. The use of nylon cable ties to support MC cable is not allowed.

    f. Use lock or spring nut MC cable fittings.

    g. Cable runs shall be continuous from wiring device to wiring device – no intermediate splicing J-boxes allowed.

    h. When terminating or splicing at a junction, outlet, or switch box, cut the cable with an armored cable rotary cutter such that 6-inches of free conductors remain for connections or splices. Use screw-in or spring lock connector and ensure a proper bonding by firmly tightening the connector to both the box and cable. Insert an anti-short bushing at cable ends to protect conductors from abrasion and use insulated connectors.

i. MC cable bend radius shall not e less than seven (7) times the external diameter of the cable.

j. MC cables passing through fire-rated walls or floors shall be firestopped as required with a UL listed system. See firestopping requirements outlined elsewhere in this specification for additional requirements.

k. Installation shall not exceed code requirements for total current carrying conductors in multiple MC Cable runs bundled together into a single MC cable hanger or strap, unless support device is specifically listed for such purpose. Neutrals shall be counted as current carrying conductors.

l. Maintain MC Cable clearance of at least 6 inches from hot water and any other high temperature pipes. Maintain at least 12-inches clearance between MC cable(s) and telecommunication conduits and cables. MC cable shall cross telecommunication cables and conduits at right angles.

m. MC cabling shall not be run through exposed ceilings, where open grid conditions exist, exposed on walls, or exposed to view. See Power Plan and Lighting Plan General Notes for additional requirements.

40. Installation of Electrical Nonmetallic Tubing (ENT) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing).

a. When approved for use in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing, 1/2" and 3/4” trade size ENT shall be allowed for concealed lighting branch circuits, receptacle branch circuits and miscellaneous signal system circuits within concrete floors, walls and columns within parking structures.

b. ENT conduit shall meet the requirements of Underwriters Laboratories Standards 1479 and 1655, NEMA TC-13, and be UL-listed.

c. All ENT conduit, ENT fittings, ENT boxes and ENT accessories shall be UL listed and manufactured by the same manufacturer so as to form a complete ENT system. ENT systems shall only be used if they are listed for use in fire resistance rated concrete floors and ceilings with resistance ratings as indicated elsewhere in the project plans. ENT system shall comply with NEC, or CEC where adopted, Article 362.

d. All ENT fittings and ENT boxes shall be concrete-tight listed without the use of tape. Additionally, ENT fittings shall be constructed of high impact PVC and able to resist ENT conduit pull out forces of a minimum of 175 lbs. ENT fittings with fewer than 6 locking tabs for ENT connection shall utilize manufacturer approved glue as additional protection from fitting/conduit separation. ENT conduit to rigid conduit transition fittings shall be equipped with set screw fittings on the rigid conduit side of the fitting. ENT to metal box fittings shall be equipped with a threaded end and lock washer.

e. Where tubing enters a box, fitting, or other enclosure provide a bushing or adapter to protect conductors from abrasion unless the box, fitting, or enclosure design provides equivalent protection.

f. ENT junction boxes shall have brass screw inserts and shall be rated to support lighting fixtures weighing less than 50 lbs.

g. Concrete tight metal boxes shall be used to support pendant hung fixtures or fixtures over 50 lbs.

h. ENT shall be provided in continuous lengths between junction boxes without use of in-line splices or connectors and shall be clearly marked/labeled at least every 10 feet.

i. All ENT conduit containing electrical branch circuits shall contain a code-sized equipment ground conductor.

j. ENT shall transition to EMT, IMC, RMC, or rigid PVC, as appropriate or as called out elsewhere in this specification, for all exposed conduits within/on/under a parking structure.

k. ENT shall transition to appropriately sized PVC expansion joint(s) at all structure expansion or seismic joints.

l. ENT shall be securely fastened and supported every 2 – 3 ft. and within 1 ft. of every junction box and fitting to prevent movement and sag.

m. ENT shall be routed straight without sags, or excessive bending. Where bends are required, comply with Table 362.24 of the NEC for minimum radius of bends. Number of bends shall not exceed quantity allowed by code where used for power and lighting branch circuit and/or feeder conductors. Where utilized for communications system conductors (phones, data cabling, etc.) number of bends shall not exceed the equivalent of (2) 90-degree bends with conduit length no more than 100 feet without installation of a TIA 569-compliant pull box.

n. Separation of ENT from fittings, excessive sags, or deflections in ENT runs that prevent pulling of wire and other ENT system product or system installation failures/errors shall be corrected by saw cutting and patching as necessary at no additional cost to the Owner. Use of surface mounted conduits and junction boxes as a repair method is unacceptable.

o. Empty ENT runs shall be provided with a nylon pull string.

p. Coordinate installation of raceway with structural steel and other structural members. Do not cut, notch or otherwise alter structural members without obtaining approval in writing from the Structural Engineer of record.

q. No more than (2) 3/4” ENT conduits may cross each other within a horizontal concrete slab without obtaining approval in writing from the Structural Engineer of record.

B. Installation of 600-Volt Conductors:

1. All electrical wire, including signal circuits, shall be installed in conduit.

2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.

   a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y or equal as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the spring connector. THE USE OF PUSH-WIRE CONNECTORS (e.g. “WAGO” OR EQUIVALENT) IS STRICTLY PROHIBITED.

   b. Wires #4 AWG and larger AWG shall be joined together as follows:

      1) When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.

      2) When located in an interior environment, the splice shall be made with an Ilsco or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90-degree Celsius rated conductors.

   c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.

3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.

4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.

5. For 20A branch circuit wiring, increase #12 conductors to #10 for 120-volt circuits longer than 100 feet and for 277V circuits longer than 150 feet.

6. Conductor Support: Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.

C. Grounding/Bonding:

1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein, and as required by applicable codes. Included, but not limited to, are items that require grounding/bonding:

   a. Conduit, Raceways and Cable Trays.

   b. Neutral or identified conductors of interior wiring system.

c. Panel boards, Distribution Boards, Switchgear and Switchboards.

d. Non-current carrying metal parts of fixed equipment.

e. Telephone distribution equipment.

f. Transformers, Inverters, UPS, PDU, RDC, Transfer Switch and Generator Systems.

g. Raised Flooring.

h. Exposed metal in maintenance holes, hand holes.

i. Lightning Protection Systems and Antennas.

j. Metal piping installed in or attached to a building/structure.

k. Metallically isolated structural steel.

l. Metallically isolated underground metal water piping.

m. Elevator hydraulic piston/lift case.

2. In multi-occupancy buildings, Contractor shall bond metal water piping systems instated in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallically isolated from each other. Per NEC, or CEC where adopted ART. 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panel board serving that suite/occupancy.

3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and NEC (CEC, where adopted), unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.

4. Grounding System Connection:

   a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.

b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.

c. Mechanical connectors shall not be used.

5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point, and shall be distinguished from other ground wires by a continuous yellow stripe.

6. Provide separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through #10 AWG. Use NEC (or CEC where adopted) Table 250.122 for conductor size with phase conductors #8 and larger, if not shown on the Drawings.

7. Clean the contact surfaces of all ground connections prior to making connections.

8. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.

9. Motors: Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.

10. Building grounding system resistance to ground shall not exceed 25 ohms unless otherwise noted and should be confirmed by testing.

D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units:

1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by the Contractor for each item or mechanical equipment.

2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.

3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.

4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.

5. Unless otherwise noted, the Contractor shall furnish and install all conduit, boxes, wires, etc., for line voltage wiring and low voltage wiring.

6. It is the Contractor's responsibility to verify with the drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.

7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.

E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.

F. Firestopping:

1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services in conjunction with the selection and installation of a complete, fully functioning, code compliant, UL-listed, fire stop assembly/system(s) as required by project conditions.

2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current UL listing, as indicated in the latest edition of the UL Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each fire stop assembly/system in accordance with the manufacturer's printed instructions.

3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.

G. Housekeeping Pads

1. Provide a minimum 3" high housekeeping pad above finished floor/finished grade for all floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, etc., flush with the face of the equipment. Located in mechanical central plant(s), other mechanical spaces, and located outdoors, pads shall be flush with the face of the equipment. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

2. Unless otherwise noted above, provide a minimum 1-1/2" high housekeeping pad above finished floor/finished grade for all interior floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, transfer switches etc., flush with the face of the equipment. All housekeeping pad heights are as measured from finished floor or grade. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

3. Provide a 1-1/2" high housekeeping pad above finished floor/finished for service equipment. Prior to pad rough-in, Contractor shall verify serving utility company's maximum meter height requirements and, if necessary, adjust height of housekeeping pad to comply with those requirements. In indoor applications, the pad shall be flush with the face of the switchgear. In outdoor applications, the housekeeping pad shall extend a minimum of 4 feet from the front of switchgear/switchboard's weatherproof enclosure. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

4. All housekeeping pads located in, on or attached to a building shall be seismically braced/connected to the building structure.

END OF SECTION

SECTION 28 46 00

FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED WORK

A. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 1 and 26 of these specifications.

B. All applicable portions of Section 26 00 00 shall apply to this section as though written herein completely.

1.2 GENERAL REQUIREMENTS

A. The contractor shall hold a valid State of California C-10 Low-Voltage license, shall have completed at least 20 projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least five years, and capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

B. The contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.

C. All work shall be performed under the supervision of a company accredited by the basic equipment manufacturer and such accreditation must be presented.

D. The installing contractor shall be a factory authorized distributor and warrantee station for the brand of equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The installing contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractors shop.

E. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the installing contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

F. The fire alarm contractor shall be UL listed company under the UL classification of (UUJS). The installation company shall UL certify this installation.

G. The fire alarm contractor shall have a NICET Certified and Technicians on staff in their facility directly involved with this project to ensure technical expertise to this project and adherence with these specifications.

H. The fire alarm contractor shall maintain sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 8 hours of service calls, 24 hours a day, 7 days a week to service completed systems.

I. Equipment, wire and materials shall only be installed by the fire alarm contractor / manufacture's distributor. A Contractor other than the manufacturer's distributor used to install the system is not acceptable.

J. The fire alarm contractor/distributor shall provide, install and test all equipment related to this section.

K. The contractor shall pay all charges (including travel, lodging, meals, etc…) required to provide factory certification, equal to that of a Factory Authorized Distributor of the substituted item, for two (2) selected Owners representatives. This training shall occur at the primary factory of the substituted item in question and shall allow the selected Owners representatives to provide any and all Factory / Manufacturer Approved repairs, services, software upgrades, etc. without affecting any available or applicable Manufacturer Warranties.

1.3 QUALITY ASSURANCE

A. Equipment shall be as manufactured by Fire-Lite per District standard. No other manufacturer's will be allowed by the District.

B. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment with the most current software package available at the time of installation. At the time of Owner Acceptance of the installation, all equipment shall include any and all updated software revisions. In addition, when the software is available in disk format, a backup copy of the most up to date revision, in disk format, shall be handed to the Owner at the completion of the project.

1.4 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

C. The system shall be support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall

be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.

D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

E. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994

F. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

G. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

H. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.5 SCOPE:

A. An existing intelligent reporting, microprocessor controlled fire detection system shall be utilized in accordance to the project specifications and drawings.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).

2. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

4. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

6. NAC audible circuits shall be arranged such that there is a minimum of one audible circuit per floor of the building or smoke zone whichever is greater.

7. Tone generating equipment shall be electrically supervised for normal and abnormal conditions.

8. NAC audible circuits and control equipment shall be arranged such that loss of any one (1) audible circuit will not cause the loss of any other audible circuit in the system.

   Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.

9. Tone generating equipment shall be electrically supervised for abnormal conditions.

1.6 GUARANTY:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 3 years.

1.7 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.8 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. Local and State Building Codes.

C. All requirements of the Authority Having Jurisdiction (AHJ).

1.9 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

   UL Underwriters Laboratories, Inc.

   ULC Underwriters Laboratories Canada

FM Factory Mutual

FM 6320 Factory Mutual Gas Detection System

NYFD New York Fire Department

CSFM California State Fire Marshal

The system shall be certified for seismic applications in accordance with the International Building Code (IBC).

1.10 SUBMITTAL AND MANUAL

A. Comply with all requirements of the General Conditions, Supplementary Conditions and applicable sections of Divisions 1 and 16 of these specifications.

B. Additional requirements of this section are:

1. Within thirty-five (35) calendar days after the date of award of the Contract, the Contractor shall submit eight copies of the complete submission to the Architect for review.

2. The submission shall consist of five major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.

3. The first section shall be the "index" which shall include the project title and address, name of the firm submitting the proposal and name of the Architect.

4. The second section shall include the following items:

a. CONTRACTOR'S LICENSE: A copy of the electronics contractor's valid State of California License.

b. PROOF OF EXPERIENCE: Proof that the fire alarm contractor has been regularly engaged in the business of fire alarm contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of fire alarm systems of the type specified herein for at least the past ten (10) consecutive years. Provide a statement summarizing any pending litigation involving any officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst case scenario. Non-disclosure of this item, if later discovered, may result, at the owner's discretion, in the contractor bearing all costs and any cost related to associated delays in the progress of the work.

c. INSURANCE CERTIFICATES: Copy of fire alarm contractor's current liability insurance and state industrial insurance certificates in conformance with the contract documents.

d. PROJECT LIST: A List containing at least ten (10) California installations completed within the last five (5) years by the fire alarm contractor that are comparable in scope and nature to that specified in the contract document.

e. SERVICE CAPABILITY: Documentation indicating in detail that the fire alarm contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 100 air miles of the job site.

f. AUTHORIZATION LETTERS: Letters from the fire alarm equipment manufacturer stating that the fire alarm contractor is the Factory Authorized Distributor, and is trained and certified for the equipment he proposes to use on this project, and is licensed to purchase and install that software required to provide the specified functions.

g. CERTIFICATION:

1. Proof that the fire alarm contractor is Underwriters Laboratories, Inc. (UL) listed under the classification of "PROTECTIVE SIGNALING SERVICES-LOCAL, AUXILIARY, REMOTE STATION AND PROPRIETARY (UUJS).

2. Copy of the following (NICET) Certificates. Proof that the certificate holders are a part of the fire alarm contractor's local facility servicing this project and will be actively involved in this project.

a. Technician Level 2 minimum of (5).

b. Technician Level 4 minimum of (1)

h. PROOF OF TRAINED PERSONNEL:

1. Documentation that the fire alarm contractor has on staff personnel factory-trained and certified for the equipment proposed for this project. Also, a statement that personnel meeting these qualifications are in the local facility, and will be maintained at that facility throughout the project and the warranty period.

5. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all of the specified equipment's features and functions as stated in the specifications and data sheets. Include CSFM listing sheet for each component.

6. The fourth section shall contain an original factory data sheet for every component in the specifications.

7. The fifth section shall contain a designation schedule for each Structured Cabling System location and complete 1/8" = 1'-0" scale drawing showing system wiring plans.

a. Riser Diagram.

b. Typical Device Wiring Diagram.

c. Wire Legend, including types for zones and devices and color coding to be utilized.

d. Battery Calculation for each control panel, power supply, field power supply and network annunciator.

e. Worst Case Voltage drop for each circuit type per building.

f. Floor Plans showing all conduits, sizes, quantity of conductors.

g. Mounting Height of each devices and back box requirement.

h. Zoning and address description legend.

C. Failure to comply with all of the requirements listed above will result in the rejection of the entire submittal package.

D. The Contractor shall provide two copies of an "Operating and Servicing Manual" for the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: Instructions necessary for the proper operation and servicing of the system; complete as-built installation drawings of the system; a wiring destination schedule for each circuit leaving for each piece of equipment; a schematic diagram of major components with all transistor and IC complements and replacement number.

PART 2 - PRODUCTS

2.1 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

A. Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply by Fire-Lite. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:

1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.

2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.

3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

2.2 SYSTEM CAPACITY AND GENERAL OPERATION

A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps.

C. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.

D. The FACP shall be able to provide the following software and hardware features:

1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.

3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.

4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.

5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.

6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.

7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.

8. Programmable Trouble Reminder: The system shall provide means to automati-

cally initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.

9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.

10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.

11. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.

12. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.

13. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions

14. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.

15. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

16. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.

17. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.

18. Read status preview - enabled and disabled points: Prior to re-enabling points,

the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.

19. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.

20. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result ofall cooperating detectors chamber readings.

21. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.

22. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.

23. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

24. Security Monitor Points: The system shall provide means to monitor any point as a type security.

25. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

26. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input

point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.

27. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.

28. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.

29. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.

30. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.

31. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.

32. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

33. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

E. Network Communication

1. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels/nodes per network.

F. Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.

2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.

4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.

5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.

6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

G. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.

2. The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

H. Loop (Signaling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.

2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.

3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit.

4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

I. Controls with associated LED Indicators:

1. Audible Switches/Indicators

a. The audible circuit control switches/indicators shall include visual indication of active and trouble status for each audible circuit in the system.

b. The audible circuit control panel shall include switches to manually activate or deactivate each audible circuit in the system.\

2. Emergency Two-Way Telephone Control Switches/Indicators

a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.

b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

J. Remote Transmissions:

1. Provide local energy or polarity reversal or trip circuits as required.

2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.

3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.

4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

K. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.

2. All field defined programs shall be stored in non-volatile memory.

P. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.

2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.

2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.

3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:

   a. Device Status.

   b. Device Type.

   c. Custom Device Label.

   d. Software Zone Label.

   e. Device Zone Assignements.

   f. Analog Detector Sensitivity.

   g. All Program Parameters.

4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.

5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.

6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.

7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

2.3 SYSTEM COMPONENTS:

A. Conventional Aspirating Detection

1. An optional air aspiration detection system shall be available.

2. The aspirating system shall support multiple sensitivity settings.

3. The aspirating system shall operate from 24 VDC.

4. The aspirating system shall provide alarm and trouble relays used to activate a fire alarm control panel.

B. Portable Emergency Telephone Handset Jack

1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on plans. Handset jacks shall be approved for emergency telephone system application.

2. Insertion of a remote handset plug into a jack shall send a signal to the fire command center which shall audibly and visually indicate the on-line condition, and shall sound a ring indication in the handset.

3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

C. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.

2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.

3. The two-way emergency telephone system shall support a maximum of seven (7) handsets on line (off hook) without degradation of the signal.

D. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.

2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.

3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.

4. Communication shall include vital system status such as:

    a. Independent Zone (Alarm, trouble, non-alarm, supervisory)

    b. Independent Addressable Device Status

    c. AC (Mains) Power Loss

    d. Low Battery and Earth Fault

    e. System Off Normal

    f. 12 and 24 Hour Test Signal

    g. Abnormal Test Signal (per UL requirements)

    h. EIA-485 Communications Failure

    i. Phone Line Failure

5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

6. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.

7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.

8. An IP or IP/GSM Communicator option shall be available to interface to the

UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

E. Field Wiring Terminal Blocks

1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

F. Printer

1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.

2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

2.4 GATEWAY & WEBSERVER OPTIONS

A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.

B. LEDSIGN Gateway: The system shall support an optional and proprietary LEDSIGN Gateway to interface to LED signs that will automatically display emergency messages. The signs shall be capable of storing up to 100 messages that can be activated via system programming with the ability to be manually overridden. The Sign Gateway shall support up to 10 independent signs, each sign capable of playing an independent message. Multiple LEDSIGN Gateways can be used in network applications. An LEDSIGN gateway shall be available from the fire alarm control panel manufacturer.

C. BACnet Interface Gateway: The system shall be capable of being interfaced with BACNet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.

D. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.

E. Noti-Fire-Net Gateway: The system shall support an IP based gateway to enable the panel or local Noti-Fire-Net to be connected to an ONYXWorks workstation via the Internet or Intranet. This gateway shall also support the ability to integrate the system to an interactive firefighter's display. The Noti-Fire-Net Gateway shall be available from the fire alarm control manufacturer.

F. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.

G. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager Utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.

2. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.

3. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.

4. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.

5. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.

6. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the

LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.

7. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.

8. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.

9. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.

10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

11. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

12. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.

13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

14. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Ionization Smoke Detector: The intelligent ionization smoke detector shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

E. Intelligent Multi Criteria Acclimating Detector: The intelligent multi-criteria detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

1. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).

2. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

F. Intelligent Thermal Detectors: The intelligent thermal detectors shall have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

G. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely.

H. Advanced Multi-Criteria Intelligent Detector

1. Intelligent multi-criteria fire detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.

2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.

3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.

4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.

5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.

6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.

7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single

alarming unit.

8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.

9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which is at least 1.5 inches (3.81 cm) deep. Mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

    a. 4.0" (10.16 cm) square box with and without plaster ring.

    b. 4.0" (10.16 cm) octagonal box.

    c. 3.5" (8.89 cm) octagonal box.

    d. Single-gang box.

10. Meets Agency Standards

    a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems

    b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems

    c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

I. Advanced Multi-Criteria Intelligent Fire/CO Detector

1. Advanced Multi-Criteria Fire/CO detector shall be an addressable advanced multi-criteria smoke detector with a separate signal for carbon monoxide (CO) detection per UL 2075 standards.

2. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.

3. The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.

4. The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.

5. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20 percent of the drift range is remaining, when 100 percent of drift range is used, and when there is a chamber fault to show the unit requires maintenance.

6. The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.

7. The detector shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detector shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 159 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.

8. The detector shall provide a test means whereby it will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There shall be four test methods: functional magnet, smoke entry aerosol, carbon monoxide aerosol or direct heat method.

9. The detector shall provide two LEDs to provide 360° visibility. The LEDs shall be placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. The detector must be capable of connecting to a sounder base that provides both temporal 3 and temporal 4 patterns for fire and CO alarm.

10. Two LEDs on the sensor shall be controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, shall cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.

11. The detector shall be plug-in mounted into a twist-lock base. The detector shall be constructed of off-white, UV-resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. The mounting base shall be mounted on a junction box that is at least 1.5 inches (3.81 cm) deep. The mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

    a. 4.0" (10.16 cm) square box with and without plaster ring.

b. 4.0" (10.16 cm) octagonal box.

c. 3.5" (8.89 cm) octagonal box.

d. Single-gang box.

e. Double-gang box

2. Meets Agency Standards

a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems

b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems

c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

d. UL 2075 – Gas and Vapor Detector and Sensors – Systems Connected

J. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.

2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits.

K. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).

2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits.

L. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.

2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;

3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits.

M. Addressable Releasing Control Module

1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids.

2. The module shall operate on a redundant protocol for added protection.

3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.

N. Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display.

1. The module shall support programming of up to five programmable event thresholds.

2. The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the FMM-4-20 monitor module and industry standard 4-20 mA gas detectors.

O. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions.

2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of wires;

4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

P. Addressable Two-In / Two-Out Monitor/Relay Module:

1. An addressable Two-In / Two-Out module shall be available.

2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

Q. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

R. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.

2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.

3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.

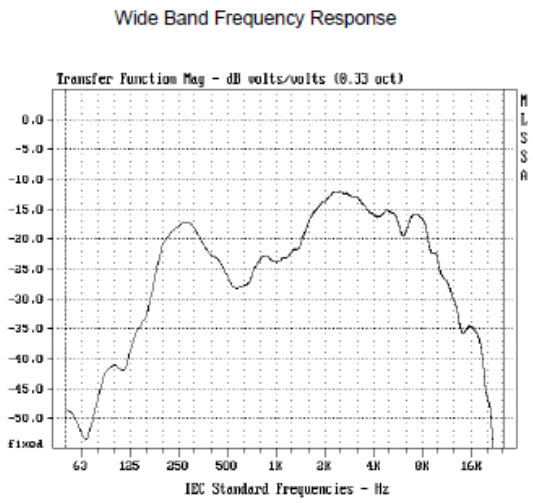
4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.

5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.

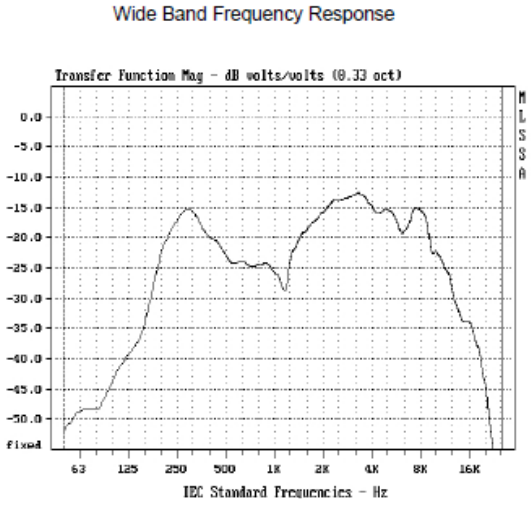
6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.

7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

Ceiling Audible



Wall Audible



Note: The wide band frequency response is derived using MLS methods

S. Horn Strobes

1. The audible strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer audible strobe capable of operation at 25.0 or 70.7 nominal Vrms. The audible shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.

2. A universal mounting plate shall be used for mounting ceiling and wall audible strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance audible strobes and the Sync•Circuit™ Module MDL3 accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the Sync•Circuit Module MDL3, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to 33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

3. Audible strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Audible strobe design shall isolate audible components to reduce ground fault incidents.

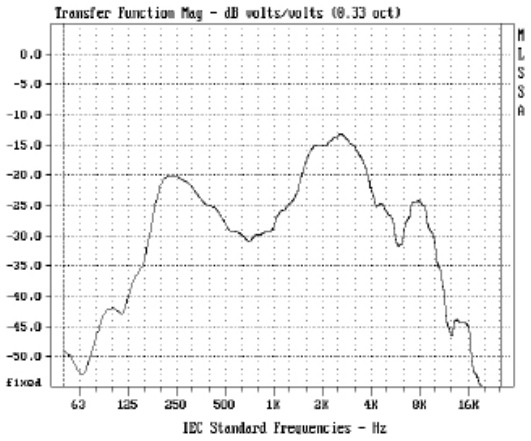
4. The audible strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound

output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.

5. All notification appliances shall be backward compatible.

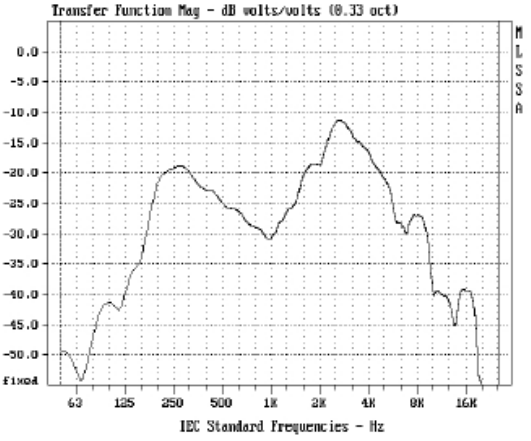
Ceiling Audible Strobe

Wide Band Frequency Response



Wall Audible Strobe

Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA & 2022 CBC, UL Standard 1971and be fully synchronized.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4 INSTRUCTION:

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a

typewritten "Sequence of Operation."

END OF SECTION

SECTION 310000 – EARTHWORK

Part 1 General

1.1 SCOPE

A. This section sets forth miscellaneous provisions applicable to coordination of all work required and operations performed under this Contract.

1.2 COORDINATION

A. Coordinate the various trade activities for connections between various building elements and systems; and to design requirements to achieve visual relationships and alignments intended between adjacent or different types of work and finishes.

B. Drawings show diagrammatic locations of equipment, piping, ducts, conduits, reinforcements, etc. Bring discrepancies to the Architects attention immediately for resolution prior to installation.

C. The Contractor shall be responsible for advance notification for specific tests and inspections as specified or required for certain items.

1.3 REQUIREMENTS

A. Coordinate scheduling, submittals, and work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

B. Set up control procedures so that approved schedules are adhered to. Contractor's responsibility is to properly notify Owners Representative anticipated and actual time delays.

C. Interruption of Services: Adequate advance notice (a minimum of 72 hours) shall be given to the Project Manager when interruptions of utility services or interferences with the use of existing buildings and roads are anticipated. Any interruption of utility services will be made by Contractor upon such notice.

1.4 MEETINGS

A. The Contractor shall schedule and hold general project coordination meetings at regularly scheduled times as required that are convenient for the attendance of Contractors and other parties involved. These meetings are in addition to specific meetings held for other purposes, such as regular project meetings and special pre-installation meetings. The Contractor shall conduct meetings in a manner that resolves coordination problems.

B. Distribute copies of the meeting results to everyone in attendance and to others affected by the decisions and actions resulting from each meeting.

1.5 SUBMITTALS

A. Schedule and coordinate submittals specified in Section 01 33 23 - Samples and Shop Drawings.

B. Coordination Drawings: The Subcontractor shall prepare coordination drawings where work by separate entities requires fabrication off-site of products and materials which must accurately interface. Coordination drawings shall indicate how work shown by separate shop drawings will interface and shall indicate installation sequence.

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

1.6 LAYOUTS, LINES AND LEVELS

A. Contractor shall provide, coordinate and check all other dimensions and levels as necessary for detailed layout work. Contractor shall protect and maintain any survey points or lines found existing or provided by Owner and shall replace same to correct positions if removed or disturbed.

1.7 FIELD MEASUREMENT & DRAWING DIMENSIONS

A. Before ordering any material or doing any work, the Subcontractor shall field verify all dimensions and measurements with the Contract Documents. Any significant differences shall be promptly reported. No claims for additional Subcontractor costs or time will be recognized for any conditions not so reported.

B. Actual dimensions on drawings or notes indicating dimensions shall be used instead of measurements of the drawings by scale and shall be strictly complied with. Measurements necessary shall be made of adjacent or incorporated work before undertaking any work dependent upon such data.

C. Assemble and coordinate closeout submittals specified in Section 01 77 00, "Contract Closeout".

1.8 EXAMINATION OF PREPARATORY WORK

A. Before starting a section of work, examine all preparatory work and substrata that has been executed to receive work. Promptly notify the Contractor of any defects or imperfections in preparatory work which will in anyway, affect satisfactory completion of his work. Absence of such notification will be construed as an acceptance of preparatory work, and later claims of defects or delays therein will not be recognized.

1.9 MANUFACTURER'S SPECIFICATIONS

A. Manufacturers’ specifications and printed instructions for installing materials, equipment and appurtenances as a part of this Contract shall govern the installation unless in conflict with other more stringent specified requirements, in which case the approval of the Architect shall be obtained before proceeding.

1.10 ADMINISTRATIVE/SUPERVISORY PERSONNEL

A. Contractor shall provide General Superintendent and supervisory personnel required for performance of the work. Provide a Project Manager as required who is experienced in administration and supervision of building construction.

B. Contractor's job superintendent to be on the job continuously. Employ and use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for timely and proper performance of the completion of work of this Section.

1.11 LIMITATIONS ON USE OF THE SITE

A. The Contractor shall administer allocations of available space equitably among the separate Subcontractors and other entities needing access and space. Each Subcontractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

B. Coordinate use of Project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on Drawings. Make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, maintenance, and repairs.

1.12 MANUFACTURER'S INSTRUCTIONS

A. Where installations include manufactured products, the Contractor shall comply with the manufacturer's applicable instructions and recommendations for installation, to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the Contract Documents.

1.13 INSPECTION PRIOR TO INSTALLATION

A. The Contractor shall, as applicable to his work, inspect each item of materials or equipment immediately prior to installation and reject damaged and defective items.

B. The Contractor shall provide attachment and connection devices and methods for securing work properly. Secure work true to line and level, and within specified or recognized industry tolerances. Allow for required expansion and building movement. Provide uniform joint width in exposed work.

Arrange joints in exposed work to obtain the best visual effect, or as otherwise indicated. Refer questionable visual-effect choices to the Architect for final decision.

1.14 ENCLOSURE OF THE WORK

A. The Contractor shall coordinate the closing-in of the work with required inspections and tests, so as to minimize the necessity of uncovering work for that purpose.

1.15 MOUNTING HEIGHTS

A. Where mounting heights are not indicated, the mounting height choices shall be referred to the Architect for final decision prior to installation, but shall comply in any event with applicable codes, including Title 24, CCR and ADA.

1.16 CLEANING AND PROTECTION

A. Contractor shall clean and protect work in progress and adjoining work on the basis of continuous maintenance; and shall apply protective covering on installed work where it is required to endure freedom from damage or deterioration at the time of Substantial Completion.

B. The Contractor shall remove rubbish and waste material resulting from his work frequently, as required, to keep site clear at all times.

C. Coordinate completion and clean up of work of separate sections in preparation for Owner or City occupancy.

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

1.17 CONSERVATION AND SALVAGE

A. Contractor's supervision and administration of the work is to include, that construction operations be carried out with the maximum possible consideration given to conservation of energy, water and materials. In addition, maximum consideration shall be given to salvaging materials and

equipment involved in performance of the work, but not incorporated therein. Refer to demolition plans (civil drawings) for required disposition of salvage materials which are the property of the Owner.

B. The Contractor shall advise the Owner of the removal and delivery of items to be salvaged, not less than 48 hours in advance.

C. Salvage material to be delivered to a location within a 10 mile radius of the Project site, as directed.

D. Excess excavation of earth and other material removed as part of the work shall become property of Contractor and be removed from site unless otherwise specified.

1.18 FERROUS WORK

A. Permanently exposed to exterior or below grade metal shall be galvanized; related accessory members and fastenings nonferrous, galvanized or made rustproof by approved methods; unless otherwise specified.

1.19 GALVANIZING

A. Galvanizing, prime painting and related touch-up and repair shall comply with Section 05 50 00 - Miscellaneous Metal and 09 91 13 & 09 91 23 – Exterior & Interior Painting.

1.20 ISOLATION

A. Provide between ferrous and nonferrous or dissimilar metal components to protect the work against electrolysis.

1.21 HOLES AND CUTOUTS

A. Provide holes, slots, cutouts, blocking, screeds, nailers, chases and similar preparation as the work progresses, as required, to receive or pass subsequent work without damage to previously completed work.

1.22 EXTERIOR WORK

A. Exterior work shall be made tight to protect against direct or indirect entry of water into the concealed or interior spaces of the building. Joints or penetrations below grade or behind exterior trim and other conditions where water might enter the structure shall be caulked or sealed as for exposed exterior work.

1.23 MISCELLANEOUS PROVISIONS

A. Requests for information (RFI's) by Contractor shall be submitted to Architect a minimum of ten (10) working days prior to required time of response.

B. Contractor shall reject and return all defective materials and re-do any substandard work without waiting for their rejection by the Architect; and shall check and verify adequate performance or satisfactory results of all tests and inspections before allowing subsequent work to proceed.

C. During guarantee period, Contractor shall supervise investigation and correction of failures or deficiencies found or occurring in the work.

1.24 GEOTECHNICAL INVESTIGATION DATA

A. Soil, geologic, and seismic investigations were conducted at Project Site, and results are to be found in following report:
   1. Report No. 26-0077, dated May 4, 2026
   2. Report: Geotechnical Investigation
      Redondo Union High School – Stadium Concourse Seahawk Bowl Improvements
      1000 Del Amo Street
      Redondo Beach, California 90277
      Prepared for Redondo Beach Unified School District

B. Report Prepared By: Koury Engineering & Testing, Inc.
   5711 Schaefer Avenue
   Chino, CA 91710

C. Geotechnical investigation data is included as part of Contract Documents, and is made available by Owner.
   1. Bidders are strongly urged to examine entire geotechnical investigation data and make their own examination of Site prior to bidding.
   2. Bidders must make their own determination of conditions which affect performance of Work.

D. Report data on indicated subsurface conditions is not intended as representations or warranties of accuracy or continuity between soil borings.
   1. It is expressly understood that Owner, Architect, and Geotechnical Consultant will not be responsible for interpretations or conclusions drawn therefrom by Bidder.
   2. Owner, Architect, and Geotechnical Consultant further disclaim responsibility for interpretation of data by bidders, as in projecting soil-bearing values, rock profiles, soil stability and presence, level and extent of underground water.

E. Additional Test Borings and Other Exploratory Operations:
   1. Prior to bidding, bidders may request permission to make their own subsurface investigations to satisfy themselves as to site and subsurface conditions at no cost to Owner.
      a. Such investigations may be performed only under time schedules and arrangements approved in advance by Owner and Architect.
   2. Upon completion of additional exploratory work, restore Site as directed by Owner.
      a. Backfill test holes and pits using removed material.
      b. When removed material is not sufficient, provide additional compatible material of similar character to native soil.
      c. Compact backfill to same density as adjacent soil.
   3. Contractor shall be fully responsible for deductions or conclusions made on basis of information or data collected from additional exploratory work.

F. Project Geotechnical Engineer will be retained by Owner to observe performance of Work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests.

G. Readjust Work performed that does not meet technical or design requirements, but make no deviation from Contract Documents without specific and written approval from Architect.

H. In addition to complying with requirements of governmental agencies having jurisdiction, comply with directives of Project Geotechnical Engineer at Project Site during earthwork operations.
   1. Notify Architect of discrepancies in specifications and actual site conditions, or

of discrepancies between Project Geotechnical Engineer's directives and Contract Documents.

2.0 PRODUCTS – Not Used

3.0 EXECUTION

3.01 EXCAVATION

A. Excavation Classifications: The following classifications of excavation will be made when rock is encountered:
   1. Earth excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

3.02 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.03 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade and shape stockpiles for proper drainage.

   1. Locate and retain soil materials horizontally away from edge of excavations equal to the depth of the excavation. Do not store within drip line of trees indicated to remain.

   2. Dispose of excess excavated soil materials not acceptable for use as backfill or fill.

3.04 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of six (6) to nine (9) inches of clearance on both sides of pipe or conduit.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
   1. Where rock is encountered, carry excavation six (6) inches below required elevation and backfill with a six (6) inch layer of crushed stone or gravel prior to installation of pipe.
   2. For pipes or conduit less than six (6) inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
   3. For pipes and equipment six (6) inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for ninety (90) degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads to ensure continuous bearing of pipe barrel on bearing surface.

3.05 BACKFILL AND FILL

A. General: All fill material and backfill material shall consist of satisfactory soil material or imported soil materials as specified in Part 2 of this section, and shall be placed in maximum six (6) inch-thick compacted layers to the required subgrade elevations, except as follows:
   1. Under walks, and playground pavement, the upper four (4) inches of fill shall consist of sub-base as defined in Section 2.01D or base material as defined by Section 2.01E.
   2. Under driveway and parking lot pavement, base material as defined by Section 2.01E shall be placed in the thickness specified on the construction drawings.
   3. Under interior building slabs, the upper four (4) inches of fill shall consist of sand or rock as specified in Section 2.01B.
   4. Under piping and conduit and equipment, use sub-base materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom ninety (90) degrees of cylinder.
   5. Backfill trenches with concrete where trench excavations pass within eighteen (18) inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
      a. Concrete is specified in Division 03.
      b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Architect. Use care in backfilling to avoid damage or displacement of pipe systems.

B. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing, and perimeter insulation.
   2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
   5. Removal of trash and debris from excavation.
   6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.06 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than one (1) vertical to four (4) horizontal (1:4) so that fill material will bond with existing surface.
   1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content or slightly above, and compact to required depth and percentage of maximum density.
   2. If the unsuitable material described above is greater than twelve (12) inches thick, this material will have to be removed and recompacted as directed by the soil engineer.

B. Place backfill and fill materials in layers not more than eight (8) inches in loose depth for material compacted by heavy compaction equipment, and not more than four (4) inches in loose depth for material compacted by hand-operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content or slightly above. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or

conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.
   1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:
      a. Under foundations, building slabs and steps: Compact top eighteen (18) inches of subgrade and each layer of backfill or fill material at ninety (90) percent maximum density.
      b. Under pavements: Compact top six (6) inches of subgrade to 95% and each layer of backfill or fill material at ninety (90) percent maximum density. Compact Aggregate paving base material to 95% maximum density.
      c. Under lawn or unpaved areas: Compact top six (6) inches of subgrade and each layer of backfill or fill material at eighty (80) percent maximum density.
      d. Under walkways: Compact top twelve (12) inches of subgrade and each layer of backfill or fill material at ninety (90) percent maximum density.
   2. Moisture Control: (under the direction of the Soils Engineer)
      a. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
      b. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by disking, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.07 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
   1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
   2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
   3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

3.08 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

3.09 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

END OF SECTION - 310000

SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of vegetation, grass, grass roots, shrubs, tree stumps, trees, upturned stumps, weed growth, tree roots, brush, masonry, concrete, rubbish, debris and other materials.

B. Removal of concrete and bituminous surfaces.

C. Removal of existing fences and gates.

1.2 RELATED SECTIONS:

A. Division 01 - General Requirements.
B. Section 31 2200 - Grading.
C. Section 31 2313 - Excavation and Fill.
D. Section 31 2326 - Base Course.

1.3 SUBMITTALS

A. Shop Drawings: Submit site plan indicating extent of site clearing.

1.4 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition, as a minimum requirement.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 TREE AND STUMP REMOVAL

A. Remove trees and stumps indicated or required to be removed. Remove trees, together with bulk of roots, to a minimum depth of 4 feet below required grade, and within a radius of approximately 7 feet beyond perimeter of trunk at grade.
B. Fill and compact excavation from tree and stump removal. Fill in 6 inch layers, each compacted to 90 percent of maximum density in accordance with ASTM D1557.
C. Back filling shall not commence until the excavation is inspected and tested.

3.2 CONCRETE AND BITUMINOUS SURFACING REMOVAL

A. Break up and completely remove existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to indicated limits. Cutting shall be performed to a neat and even line with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1 1/2-inch, unless otherwise indicated. Remove concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match existing.

3.3 FENCING

A. Fencing indicated to be removed and not reinstalled shall be completely removed, including footings. Fill and compact excavations.
B. Install chain link fencing indicated to be relocated or reset in accordance with applicable requirements specified under Section 32 3113 - Chain Link Fences and Gates.

3.4 CLEANUP

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

END OF SECTION 311000

SECTION 312200 - GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General exterior grading, cutting and filling, including grading for paving, and other site improvements.

1.2 RELATED SECTIONS

A. Division 01 - General Requirements.
B. Section 31 1000 - Site Clearing.
C. Section 31 2313 - Excavation and Fill.
D. Section 31 2326 - Base Course.

1.2 PROJECT REQUIREMENTS

A. Fees: Pay as required by authorities having jurisdiction over the area.
B. Bonds: Post as required by authorities having jurisdiction over the area.
C. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.
D. Before grading, contact Underground Service Alert of Southern California (USASC) for information on public buried utilities and pipelines. Retain the services of an underground utility locator for on-site utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall conform to requirements specified in this and related sections.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.
B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

3.2 ROUGH AND FINE GRADING

A. Rough grade area sufficiently high to require cutting by fine grading:
    1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.
    2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.
    3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.

4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.
5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.

B. Base or Subgrade:

1. After subgrade has been constructed to approximate required grades, scarify to a depth of at least 6 inches:
2. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.
3. Subgrade material shall be compacted by tamping, sheepsfoot rollers or pneumatic tire rollers. Required relative compaction shall be [90] percent minimum for the top 6 inches below subgrade.
4. Install base course in accordance with Section 31 2326 - Base Course.

3.3 TEMPORARY SHORING

A. Provide temporary shoring as necessary to properly and safely support earth sides of excavations, and existing site improvements, against movement and collapse.
B. Design and Calculations: Provide in accordance with requirement of CalOHSA.
C. Remove temporary shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.4 EXCESS MATERIAL DISPOSAL

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

3.5 PROTECTION

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

END OF SECTION 312200

SECTION 31 2300 - EXCAVATION AND FILL

PART 1 – GENERAL

1.1 SECTION INDLUDES

A. Materials, equipment, and labor required to provide grading and fine grading as indicated on Drawings and as specified.

B. Work includes, but may not be limited to:
   a. Excavation, compacted engineered fill, and preparing of subgrade for building footings, slabs, walks, and pavements.
   b. Excavating and backfilling of trenches and excavations..

1.2 RELATED SECTIONS

A. Section 01 45 00 – Quality Control; soil testing requirements

B. Section 01 50 00 – Temporary Facilities and Controls; barriers and temporary controls.

C. Section 01 57 13 – Temporary Erosion and Sedimentation Controls

D. Section 02 41 13 – Site Demolition

E. Section 02 41 16 – Building Demolition

F. Section 32 11 00 – Base Courses

1.3 RELATED REQUIRMENTS

A. Excavating and Backfilling for Utility Work:
   1. Refer to Division 26 Sections for excavation and backfill required for underground electrical utilities and related buried appurtenances.

   2. Refer to Division 31 Sections for additional trenching and backfilling requirements for underground site utilities piping and related buried appurtenances.

1.4 RELATED DOCUMENTS

A. California Code of Regulations (CCR), Title 24, 2013 edition of California Building Code (CBC), Part 2, Volumes 1 and 2.

B. ASTM International (ASTM):
   1. ASTM D 1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
   2. ASTM D 2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

3. ASTM E 699 – Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

C. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO – Standard Specifications for Highway Materials and Methods of Sampling and Testing.

D. Standard Specifications for Public Works Construction (SSPWC):
   1. The “Greenbook”, current edition.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Owner shall employ and pay for qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations.

C. Testing Laboratory Qualifications: To qualify for acceptance, geotechnical testing laboratory must be Division of the State Architect (DSA) approved and demonstrate to Architect’s satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has experience and capability to conduct required field and laboratory geotechnical testing without delaying progress of Work.

D. Foundation Soils: Excavate for foundations to sizes indicated, clean and leave in condition recommended by Civil Engineer.
   1. Prior to placement of forms, reinforcing or concrete, obtain approval of Civil Engineer and DSA Project Inspector as required, for proper conditions and suitable bearing materials.

1.6 SUBMITTALS

A. Test Reports: Submit following reports directly to Architect from testing services, with copy to Contractor:
   1. Test reports on borrow material.
   2. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
   3. Field reports; in-place soil density tests.

1.7 DEFINITIONS

A. Excavation: Consists of removal of material encountered to subgrade elevations indicated and subsequent use of excavated material as fill, disposal off-site, or stockpiled for future use of materials removed.

B. Unauthorized Excavation: Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect.
   1. Unauthorized excavation, as well as remedial work directed by Civil Engineer upon receipt of written authorization from Architect, shall be at Contractor's expense.

2. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
    a. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Civil Engineer.
3. In locations other than those above, backfill and compact unauthorized excavations as specified by Civil Engineer for authorized excavations of same classification, unless otherwise directed by Architect.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Architect, who will notify Civil Engineer to make inspection of conditions.
1. Should Civil Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material specified by Civil Engineer and directed by Architect.
2. Contract sum may be adjusted by appropriate Contract modification.
3. Removal of unsuitable material and its replacement as directed shall be paid on basis of General Conditions of the Contract relative to changes in Work.

D. Subgrade: Undisturbed earth or compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.

1.8 PROJECT CONDITIONS

A. Noise and Dust Abatement: Exercise reasonable and necessary means to abate dust, dirt rising and undue noise.
1. Perform necessary sprinkling and wetting of construction site to allay dust.

B. Existing Utilities:
1. Pothole and locate existing utilities in areas of proposed excavation work prior to performing excavation.
    a. report discrepencies immediately to Architect and Civil Engineer.
2. Where utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
3. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for direction.
4. Cooperate with Owner and utility companies in keeping respective services and facilities in operation.
    a. Repair damaged utilities to satisfaction of utility owner.
5. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.
    a. Provide minimum of forty-eight hour notice to Architect and Owner and receive written notice to proceed before interrupting utility.
6 Demolish and completely remove from Project Site existing underground utilities indicated to be removed.
    a. Backfill for abandoned underground utilities shall conform to Articles 2.01 – Soil Materials and 3.05 – Backfill and Fill.
    b. Coordinate with utility companies for shutoff of service if lines are active.

C. Protection of Subgrade: Do not allow equipment to pump, rut or disturb subgrade, stripped areas, or other areas prepared for backfill or paving operations.

1.9 GEOTECHNICAL INVESTIGATION DATA

A. Soil, geologic, and seismic investigations were conducted at Project Site, and results are to be found in following report:

1. Report No. H170-397, dated August 22, 2022
2. Report: Geotechnical Investigation and Geologic Hazards Evaluation
   Whittier Elementary School Modernization
   400 W. Whittier Avenue, Hemet, California
   Hemet, California
   Prepared for Hemet Unified School District

B. Report Prepared By: Inland Foundation Engineering, Inc.
   1310 S. Santa Fe Avenue P.O. Box 937
   San Jacinto, CA 92581

C. Geotechnical investigation data is included as part of Contract Documents, and is made available by Owner.
   1. Bidders are strongly urged to examine entire geotechnical investigation data and make their own examination of Site prior to bidding.
   2. Bidders must make their own determination of conditions which affect performance of Work.

D. Report data on indicated subsurface conditions is not intended as representations or warranties of accuracy or continuity between soil borings.
   1. It is expressly understood that Owner, Architect, and Geotechnical Consultant will not be responsible for interpretations or conclusions drawn therefrom by Bidder.
   2. Owner, Architect, and Geotechnical Consultant further disclaim responsibility for interpretation of data by bidders, as in projecting soil-bearing values, rock profiles, soil stability and presence, level and extent of underground water.

E. Additional Test Borings and Other Exploratory Operations:
   1. Prior to bidding, bidders may request permission to make their own subsurface investigations to satisfy themselves as to site and subsurface conditions at no cost to Owner.
      a. Such investigations may be performed only under time schedules and arrangements approved in advance by Owner and Architect.
   2. Upon completion of additional exploratory work, restore Site as directed by Owner.
      a. Backfill test holes and pits using removed material.
      b. When removed material is not sufficient, provide additional compatible material of similar character to native soil.
      c. Compact backfill to same density as adjacent soil.
   3. Contractor shall be fully responsible for deductions or conclusions made on basis of information or data collected from additional exploratory work.

F. Project Geotechnical Engineer will be retained by Owner to observe performance of Work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests.

G. Readjust Work performed that does not meet technical or design requirements, but

make no deviation from Contract Documents without specific and written approval from Architect.

H. In addition to complying with requirements of governmental agencies having jurisdiction, comply with directives of Project Geotechnical Engineer at Project Site during earthwork operations.
   1. Notify Architect of discrepancies in specifications and actual site conditions, or of discrepancies between Project Geotechnical Engineer's directives and Contract Documents.

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

A. Imported Soil Materials: Fill soil imported to Project Site shall be granular and shall have expansion index of less than twenty and be classified as SM, SW, and SP in accordance with ASTM D 2487.
   1. Import fill shall be free of rock and lumps of soil larger than three inches in diameter and shall be at least sixty percent finer than 1/4 inch sieve.

B. Utility Trench Backfill: Material for use in backfilling trenches shall consist of hard, durable, clean sand, gravel, or crushed stone, and shall be free from organic material, clay balls, or other deleterious substances.

C. Base Material: Base material under asphalt pavements.
   1. Refer to Section 32 11 00. .

PART 3 – EXECUTION

3.1 EXCAVATION

A. Excavation Classifications: Following classifications of excavation will be made when rock is encountered:
   1. Earth excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

3.2 STABILITY OF EXCAVATIONS

A. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
   1. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
   2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.3 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed.
   1. Place, grade and shape stockpiles for proper drainage.
   2. Locate and retain soil materials horizontally away from edge of excavations equal to depth of excavation.
   3. Do not store within drip line of trees indicated to remain.
   4. Dispose of excess excavated soil materials not acceptable for use as backfill or fill.

3.4 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and minimum of six to nine inches of clearance on both sides of pipe or conduit.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
   2. Where rock is encountered, carry excavation six inches below required elevation and backfill with six inch layer of crushed stone or gravel prior to installation of pipe.
   3. For pipes or conduit less than six inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths.
      a. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
   4. For pipes and equipment six inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for ninety degrees (bottom 1/4 of circumference).
      a. Fill depressions with tamped sand backfill.
      b. At each pipe joint, dig bell holes to relieve pipe bell of loads to ensure continuous bearing of pipe barrel on bearing surface.

3.5 BACKFILL AND FILL

A. Fill material and backfill material shall consist of satisfactory soil material or imported soil materials as specified in Part 2 of this section, and shall be placed in maximum six inch thick compacted layers to required subgrade elevations, except as follows:
   1. Under Walks: Upper four inches of fill shall consist of sub-base as defined in Article 2.01D or base material as defined by Article 2.01E.
   3. Under Interior Building Slabs: Upper four inches of fill shall consist of compactable sand or rock as specified in Article 2.01B.
   4. Under Piping and Conduit and Equipment: Use sub-base materials where required over rock bearing surface and for correction of unauthorized excavation.
      a. Shape excavation bottom to fit bottom ninety degrees of cylinder.
   5. Backfill trenches with concrete where trench excavations pass within eighteen inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings.
      a. Place concrete to level of bottom of adjacent footing.
      b. Concrete is specified in Section 03300.
      c. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Architect.
      d. Use care in backfilling to avoid damage or displacement of pipe systems.

B. Backfill excavations as promptly as Work permits, but not until completion of following:
   1. Acceptance of construction below finish grade.
   2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
   5. Removal of trash and debris from excavation.
   6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.6 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.
   1. Plow strip or break up sloped surfaces steeper than one vertical to four horizontal (1:4) so that fill material will bond with existing surface.
   2. When existing ground surface has density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content or slightly above, and compact to required depth and percentage of maximum density.
   3. Where unsuitable material described above is greater than twelve inches thick, material will have to be removed and recompacted as directed by Civil Engineer.

B. Place backfill and fill materials in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content or slightly above.
   1. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations.
   1. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below.
   1. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.
   2. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:
      a. Under Foundations, Building Slabs and Steps: Refer to Geotech Report for overex and compaction requirements.
      b. Under Pavements: Compact top twelve inches of subgrade and each layer of backfill or fill material at ninety-five percent maximum density.
      c. Under Lawn or Unpaved Areas: Compact top six inches of subgrade and each layer of backfill or fill material at eighty percent maximum density.
      d. Under Walkways: Compact top twelve inches of subgrade and each layer of backfill or fill material at ninety percent maximum density.
   3. Moisture Control, under direction of Civil Engineer:
      a. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material.
      b. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
      c. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
      d. Stockpile or spread soil material that has been removed because it is too wet to permit compaction.
      e. Assist drying by disking, harrowing or pulverizing until moisture content is reduced to satisfactory value.

F. Proofrolling:

1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with fully loaded dump truck to check for pockets of soft material.
2. Perform proofrolling consisting of at least two complete passes, with one pass being in direction perpendicular to preceding one.
   a. Remove areas that deflect, rut, or pump excessively during proof rolling, or that fail to consolidate after successive passes to suitable soils and replace with compacted fill.
   b. Maintain subgrade until succeeding operation has been accomplished.

3.7 GRADING

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas.
   1. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding in accordance with precise grading plan.
   1. Finish surfaces free from irregular surface changes and as follows:
      a. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
      b. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
      c. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

3.8 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.
   1. Comply with requirements of Section 01 5713.

3.9 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion and keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Project Site.

END OF SECTION 31 23 00

SECTION 312333 – TRENCHING AND BACKFILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavation, bedding, and backfill of underground storm drain, sanitary sewer and water piping and associated structures.

1.2 SECTION EXCLUDES

A. Trenching and backfill for other utilities such as underground electric, telephone, gas, cable TV, etc.

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Refer to Geotechnical Consultant.

B. ASTM:
1. C 33, Specification for Concrete Aggregates.
2. C 150, Specification for Portland Cement.
3. C 260, Specification for Air-Entraining Admixtures for Concrete.
4. C 618, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
5. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
6. D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
7. D 2487, Classification of Soils for Engineering Purposes.
8. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
9. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
10. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.

C. California Building Code, California Code of Regulations, Title 24, Part 2 - Chapter 18, Foundations, and Retaining Walls, and Chapter 33, Site Work, Demolition and Construction.

D. Caltrans Standard Specifications:
1. Section 19, Earthwork.
2. Section 26, Aggregate Bases.
3. Section 68, Subsurface Drains.
4. Section 88, Engineering Fabrics.

E. CAL/OSHA, Title 8.

1.4 Definitions

A. AC: Asphalt Concrete.

B. ASTM: American Society for Testing and Materials.

C. Bedding: Material from bottom of trench to bottom of pipe.

D. CDF: Controlled Density Fill.

E. DIP: Ductile Iron Pipe.

F. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.

G. PCC: Portland Cement Concrete.

H. RCP: Reinforced Concrete Pipe.

I. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.

J. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.

K. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
   1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by the Geotechnical Consultant.
   2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Geotechnical Consultant. Unauthorized excavation shall be without additional compensation.

L. Utility Structures:
   1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
   2. Sanitary sewer manholes, vaults, etc.
   3. Water vaults, etc.

1.5 QUALITY ASSURANCE

A. Provide an independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock definition testing, as documented according to ASTM D 3740 and ASTM E 548.

B. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Consultant.

C. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.

D. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

E. The Geotechnical Consultant will perform observations and tests required to enable him to form an opinion of the acceptability of the trench backfill. Correct the trench backfill that, in the opinion of the Geotechnical Consultant, does not meet the requirements of these Technical Specifications and the Geotechnical Report.

1.6 SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data:
1. Grading and quality characteristics showing compliance with requirements for the Work.
2. Certify that material meets requirements of the Project.

C. Samples:
1. If required by the Geotechnical Consultant, provide 40-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material. Do not import materials to Project without written approval of the Geotechnical Consultant.
2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Consultant and the Owner's Representative's.

D. Material Test Reports: Provide, from a qualified testing agency, the following test results showing compliance with the project requirements:
1. Classification according to ASTM D 2487 of each imported trench bedding and backfill material.
2. Laboratory compaction curve in conformance with ASTM D 1557 for each imported trench bedding and backfill material

1.7 PROJECT CONDITIONS

A. Promptly notify the Owner's Representative of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner's Representative verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless Contractor has notified the Owner's Representative in writing of differing conditions prior to contractor starting work on affected items.

B. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

D. Provide dust and noise control.

PART 2 PRODUCTS

2.1 PIPE BEDDING AND INITIAL BACKFILL

A. ASTM D 2321, Class IA, IB or II.
1. Clean and free of clay, silt or organic matter.

B. Permeable Material: Conform to Section 68-1.025 of Caltrans Standard Specifications, Class 1, Type A or Class 2

C. Class 2 Aggregate Base: Conform to Section 26 of Caltrans Standard Specifications, 3/4-inch maximum.

D. Sand: Conform to Section 19-3.025B of Caltrans Standard Specifications.

2.2 SUBSEQUENT BACKFILL

A. Conform to on-site or imported structural backfill in Section 312300, Excavation and Fill.

2.3 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8-inch top size. The 3/8-inch aggregate shall not comprise more than 30% of the total aggregate content.

B. Cement: Conform to the standards as set forth in ASTM C-150, Type II Cement.

C. Fly Ash: Conform to the standards as set forth in ASTM C-618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.

D. Air Entraining Agent: Conform to the standards as set forth in ASTM C-260.

E. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.

F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.

G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

H. Mix design shall meet the Geotechnical Consultant’s approval.

2.4 CONCRETE STRUCTURE BEDDING AND BACKFILL

A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by the Geotechnical Consultant.

B. Poured-in-Place Structures:
1. Bedding: Bedding shall meet the approval of the Geotechnical Consultant. In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 23 00.

2.5 FILTER FABRIC

A. Filter Fabric:
1. Filter Fabric: Section 88-1.03 of Caltrans Standard Specifications.
2. Mirifi 140N (Mirifi Inc., Charlotte, NC) (Tel. 800-438-1855) or equal

PART 3 EXECUTION

3.1 TRENCHING AND EXCAVATION

A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12- inches beyond the edge of the trench.

B. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.

C. Excavation Depth for Bedding: Minimum of 4-inches below bottom of pipe or as otherwise allowed or required by the Geotechnical Consultant, except that bedding is not required for nominal pipe diameters of 2-inches or less.

D. Excavation Width at Springline of Pipe:
1. Up to a nominal pipe diameter of 24-inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by the Geotechnical Consultant.
2. Nominal pipe diameter of 30-inches through 36-inches: Minimum of the outside pipe diameter plus 2-feet, or as otherwise allowed or required by the Geotechnical Consultant.
3. Nominal pipe diameter of 42-inches through 60-inches: Minimum of the outside pipe diameter plus 3-feet, or as otherwise allowed or required by the Geotechnical Consultant.

E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.

F. Comply with the Owner's Representative's limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of the Owner's Representative.

G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.

H. Bottoms of trenches will be subject to testing by Geotechnical Consultant. Correct deficiencies as directed by the Geotechnical Consultant.

I. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

3.2 CONTROL OF WATER AND DEWATERING

A. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Geotechnical Consultant and the Owner's Representative until backfilling is completed.

B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.

C. Obtain the Geotechnical Consultant's approval for proposed control of water and dewatering methods.

D. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.

E. Maintain dewatering system in place until dewatering is no longer required.

3.3 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Geotechnical Consultant, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner's Representative.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.4 PIPE BEDDING

A. Obtain approval of bedding material from the Geotechnical Consultant.

B. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Consultant. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting or ponding of bedding material will not be permitted.

C. Upon completion of bedding operations, and prior to the installation of pipe, notify the Geotechnical Consultant, who will inspect the bedding layer. Do not commence pipe laying until the Geotechnical Consultant has approved the bedding.

3.5 BACKFILLING

A. Obtain approval of backfill material from Geotechnical Consultant.

B. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12-inches above the top of the pipe in layers not exceeding 8-inches in loose thickness. Compact initial backfill material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Consultant. Compact by

pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting or ponding of initial backfill material will not be permitted.

C. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8- inches in loose thickness. Compact subsequent backfill material at optimum water content to 90% relative compaction, except that the upper 36-inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by the Geotechnical Consultant. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Consultant. Jetting or ponding of subsequent backfill material will not be permitted.

D. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive pipe displacement or damage the pipe.

E. Utility backfill shall be inspected and tested by the Geotechnical Consultant during placement. Cooperate with the Geotechnical Consultant and provide working space for such tests in operations. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Geotechnical Consultant and the Owner's Representative prior to proceeding with the Project.

3.6 CLEANUP

A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner's Representative.

END OF SECTION 312333

SECTION 321100 – PAVEMENT BASE COURSES

GENERAL

SECTION INCLUDES

Aggregate subbase and base.

Cement treated base.

Lime stabilization

RELATED SECTIONS

Section 31 23 00 – Excavation.

Section 32 12 16 – Asphalt Paving.

Section 32 13 13 – Concrete Paving.

RELATED DOCUMENTS

Geotechnical Report: Refer to Geotechnical Consultant.

Caltrans Standard Specifications:
- Section 24, Lime Stabilization.
- Section 25, Aggregate Subbases.
- Section 26, Aggregate Bases.
- Section 27, Cement Treated Bases.

ASTM:
- D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

DEFINITIONS

ASTM: American Society for Testing Materials.

QUALITY ASSURANCE

Do not mix or place cement treated base when the temperature is below is below 36 degrees F or when the ground is frozen.

Conform to the appropriate portions of the Geotechnical Report, these Specifications and Section 19 of Caltrans Standard Specifications.

Finish surface of the prepared subgrade to receive aggregate subbase, aggregate base or cement treated base, shall be as specified in Section 31 23 00.

Finish surface of material to be stabilized prior to lime treatment shall be as specified in Section 24-1.04 of Caltrans Standard Specifications.

Finish surface of the stabilized material after lime treatment shall be as specified in Section 24-1.08 of Caltrans Standard Specifications.

Do not project the finish surface of aggregate subbase above the design subgrade.

Finish surface of aggregate base shall be 0 to - 0.05-feet.

Finish surface of cement treated base shall be as specified in Section 27 of Caltrans Standard Specifications.

95% compaction shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM Designation D1557.

SUBMITTALS

Submit under provisions of Division 01.

Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

PRODUCTS

AGGREGATE SUBBASE

Material: Caltrans Standard Specification Section 25.
Class 1, 2, or 3: Section 25-1.02A.

AGGREGATE BASE

Material: Caltrans Standard Specification Section 26.
Class 2, 1-1/2-inch Maximum: Section 26-1.02A.

EXECUTION

SOIL STERILANT

Furnish and apply to areas indicated in accordance with Section 32 12 16.

AGGREGATE SUBBASE

Spreading and Compacting:Sections 25-1.04 and 25-1.05 of Caltrans Standard Specifications.

AGGREGATE BASE

Watering, Spreading and Compacting: Section 26-1.035, 26-1.04 and 26-1.05 of Caltrans Standard Specifications

END OF SECTION 321100

SECTION 321216 – ASPHALT PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prime coat.

B. Tack coat.

C. Asphalt concrete paving.

D. Asphalt concrete overlay.

E. Speed bumps.

F. Asphalt curbs.

G. Pavement grinding.

H. Adjusting manholes, valves, monument covers and other structures to grade.

1.2 RELATED SECTIONS

A. Section 32 11 00 – Pavement Base Courses.

1.3 Related Documents

A. Geotechnical Report: Refer to Geotechnical Consultant.

B. ASTM:
1. D 979: Practice for Sampling Bituminous Paving Mixtures.
2. D 1073: Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. D 1188: Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
4. D 2041: Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
5. D 2726: Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
6. D 2950: Test Method for Density of Bituminous Concrete in Place by Nuclear Method.
7. D 3549: Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
8. D 3666: Specifications for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Mixtures.

1.4 DEFINITIONS

A. ASTM: American Society for Testing Materials.

1.5 QUALITY ASSURANCE

A. Testing Agency: Owner's Representative will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness of Asphalt Concrete: In-place compacted thickness of asphalt courses will be determined according to ASTM D 3549.

D. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.
   1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement may be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
      a. One core sample may be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

1.6 SUBMITTALS

A. Submit under provisions of Division 01.

B. Job-Mix Designs: Certificates signed by manufacturers certifying that each asphalt concrete mix complies with requirements.

C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

D. Herbicide Treatment:
   a. Manufacturer's technical data for products proposed for use.
   b. Certificate indicating compliance with EPA requirements.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Prime Coat: Minimum surface temperature of 60 deg F at application.
   2. Tack Coat: Minimum surface temperature of 60 deg F at application.
   3. Asphalt Concrete: Minimum atmospheric temperature of 50 deg F at application.
   4. Reinforcing Fabric: Air temperature is 50 deg F and rising and pavement temperature is 40 deg F and rising

PART 2 - PRODUCTS

2.1 ASPHALT AND CONCRETE

A. Caltrans Standard Specifications Section 39, Type B.

B. Asphalt Materials:
1. Asphalt Binder: Performance Graded in accordance with Caltrans Standard Specification Section 92.
2. Prime Coat: Caltrans Standard Specification Section 93, MC-70.
3. Tack Coat: Caltrans Standard Specification Section 94, SS1 or SS1h.

C. Maximum aggregate size shall be as follows:

AC Thickness	No. of Lifts	Max. Ag. First Lift	Max. Ag. Second Lift
¾" or 1" overlay	1	3/8" fine	-
1½" surface course	1	1/2" fine	-
2" to 2½" surface course	1	1/2" fine	-
3"	1	¾" fine	- -
4"	2	2" thick ¾" fine	2" thick ½" fine
5"	2	3" thick ¾" fine	2" thick ½" fine

D. Storing, Proportioning and Mixing Materials: Caltrans Standard Specification Section 39-3.

E. E. Pavement Reinforcing Fabric: Caltrans Standard Specification Section 88.

F. Sand: ASTM D 1073, Grade No. 2 or 3.

2.2 HERBACIDE TREATMENT

A. Commercial chemical for weed control, registered by Environmental Protection Agency (EPA).

B. Provide granular, liquid, or wettable powder form.

C. Manufacturers: Subject to compliance with specified requirements, provide products of one of following:
   a. Bayer
   b. Dow AgroSciences
   c. E.I. Du Pont du Nemours and Company
   d. FMC Corporation
   e. Monsanto Company
   f. U.S. Borax & Chemical Corporation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads

B. Proof-roll subbase using heavy pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Owner's Representative in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

3.2 PAVEMENT GRINDING

A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.

B. Grind conforms as indicated.

3.3 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS

A. General: Immediately before placing asphalt materials remove loose and deleterious material from substrate surfaces and ensure that prepared subgrade is ready to receive paving according to the Caltrans Standard Specification Section 39-4.01.

B. Prime Coat: Apply uniformly over surface of compacted-aggregate base according to the Caltrans Standard Specification Section 39-4.02. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.
   1. If prime coat is not entirely absorbed within 8 hours after application, spread excess prime coat with hand tools and broadcast sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

C. Tack Coat: Apply uniformly to all vertical surfaces against which asphalt concrete is to be placed, including existing surfaces of previously constructed asphalt or portland cement

concrete paving and to surfaces abutting or projecting into new asphalt pavement, according to the Caltrans Standard Specification Section 39-4.02.

1. Allow tack coat to cure undisturbed before paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 SURFACE PREPARATION FOR PAVEMENT AT ASPHALT CONCRETE OVERLAYS

A. Pavement Irregularities: Level with asphalt concrete, Type B, No. 4 maximum.

B. Pavement Cracks:
   1. Less than 1/4-inch wide: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion.
   2. Wider than 1/4-inch: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion and skin patch.

C. Clean surface of all material, such as leaves, dirt, sand, gravel, water and vegetation prior to applying binder of paving asphalt to existing surface.

3.5 ASPHALT CONCRETE SPREADING AND COMPACTING EQUIPMENT

A. Spreading Equipment: Caltrans Standard Specification Section 39-5.01.

B. Compaction Equipment: Caltrans Standard Specification Section 39-5.02.

3.6 ASPHALT CONCRETE PLACEMENT

A. Place, spread and compact asphalt concrete to required grade, cross section, and thickness according to the Caltrans Standard Specification Sections 39-6.01, 39-6.02 and 39-6.03.

B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections according to the Caltrans Standard Specification Sections 39-6.01 and 39-6.02.
   1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
   2. Clean contact surfaces and apply tack coat.
   3. Offset longitudinal joints in successive courses a minimum of 6 inches.
   4. Offset transverse joints in successive courses a minimum of 24 inches.
   5. Compact joints as soon as asphalt concrete will bear roller weight without excessive displacement.

3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact according to the Caltrans Standard Specification Sections 39-6.01 and 39-6.03.

B. Compaction Requirements: Average Density to be 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

C. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.

D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 ASPHALT CURBS

A. Construction: Place over compacted surfaces according to Caltrans Standard Specification Section 39-7.01 as specified for dikes. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.

B. Shape: Place asphalt concrete to curb cross section indicated.

3.10 SPEED BUMPS

A. Construct speed bumps over compacted pavement surfaces according to Caltrans Standard Specification Section 39-6. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.

B. Place asphalt concrete by hand using a template/screed designed to result in speed bump cross-section indicated after compaction.

C. Compact speed bumps with 8 ton static roller.

3.11 ADJUSTING MANHOLES, VALVES, MONUMENT COVERS AND OTHER STRUCTURES TO GRADE

A. Remove pavement, using vertical cuts, as needed to remove frame and provide for concrete collar. Do not damage adjacent pavement.
   1. Circular Covers: Cut circle with radius 6 inches larger than cover and concentric with cover.
   2. Rectangular Covers: Cut rectangle 6 inches larger than cover on all sides.

B. Install grade rings or blocking as needed to raise cover to finish grade.

C. Pour concrete collar:
   1. Bottom of Collar: Top of existing collar or 6 inches below top of proposed collar, whichever is at a higher elevation.
   2. Top of Collar: Bottom of existing asphalt pavement.
   3. Apply tack coat to all exposed surfaces.
   4. Fill excavation with asphalt concrete and, while still hot, compact flush with adjacent surface.

3.12 INSTALLATION TOLERANCES

A. Asphalt Pavement:
   1. Course thickness and surface smoothness within the tolerances specified in Caltrans Standard Specification Sections 39-6.01, 39-6.02 and 39-6.03.
   2. Total Thickness: Not less than indicated.

B. Trench Patch:
   1. Compacted surface: Within 0.01 foot of adjacent pavement.
   2. Do not create ponding.

C. Adjust Covers:
   1. Compacted surface: Up to 0.01 foot higher, and no lower, than adjacent pavement.
   2. Do not create ponding.

3.13 FIELD QUALITY CONTROL

A. The finished asphalt pavement, where not controlled adjacent structures or features, shall not vary more than 0.05 feet above or below the planned grade, and should be uniform and free of sharp breaks. Within accessible route indicated on the drawings 11B-043 it shall be exact or brought up to the attention of the civil engineer and approved in writing for any desired change.

B. The cross-section of the finished pavement shall be free of ridges and valleys and shall not vary more than 0.03 feet above or below the theoretical section at any point on the cross-section.

C. Conforms shall form a smooth, pond-free transition between existing and new pavement.

D. Contractor shall perform a flood test with engineer present to confirm above stated tolerances. If depressions are observed that deviate, contractor shall perform corrective action approved by the engineer

END OF SECTION 321216

SECTION 321236 – SEAL COAT

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division 01 apply to this section.

B. Section Includes:

1. Surface sealer over asphalt paved surfaces.

C. Related Sections:

1. Section 02740: Asphalt Pavement

2. Section 02584: Pavement Marking

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.03 QUALITY ASSURANCE

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 ("Green Book"), 2015 Edition with 2007 supplement, 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. Copies of the Standard Specifications may be obtained at the BNI Building News, 1612 S. Clementine Street, Anaheim, CA. 92802, phone 1-888-264-7483 or available on the internet at: http://www.bnibooks.com/.

A. Obtain materials from same source throughout.

B. Schedule a pre-construction conference at jobsite in advance of beginning of Work.

C. Review and resolve conflicts involving requirements of specifications. Record discussions and furnish copies to all attendees.

D. Beginning of Work means Contractor accepts all conditions.

E. Agitate bulk materials during transport.

1.04 REGULATORY REQUIREMENTS

A. Comply with local air quality management district regulations for emissions maximums.

B. Maintain control of vehicular and pedestrian traffic during seal coating operations as required for other construction activities and in accordance with local traffic authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seal Coat: The materials for sealcoat shall conform to Section 203-9 – "Sealcoat – Asphalt Based" of the Standard Specifications. Before incorporation in the Work, the Contractor shall submit a 2 Liter (2-quart) sample of undiluted sealcoat at no cost to the District.

1. 1. Seal Coat: Provide one of the following surface seals:

2.

Product Name	Manufacturer
GuardTop	Vulcan Materials Company
Over Kote	Diversified Asphalt Product
Park Top	Western Colloid Products
Sure Seal	Asphalt Coating Engineering
MasterSeal	SealMaster Pavement Products & Equipment

PART 3 - EXECUTION

3.01 REPAIRING AND SEALCOATING OF EXISTING SURFACES

A. Preparation of Surfaces:

1. Before placing the seal coat, the pavement surface shall be cleaned by sweeping, flushing or other means necessary to removal all loose particles of paving, all dirt, and all other extraneous material. This shall include vegetation in pavement cracks and between pavement and curb/gutter. Prior to removal an approved herbicide, which leaves behind a visible blue marker dye, shall be sprayed where vegetation exists. Surface contaminates, grease or oil spots shall be cleaned to allow for proper adhesion.

2. Sandblast existing painted lines and remove entirely.

3. Prior to applying seal coat material, cracks wider then 1/8 inch shall be cleaned, treated with weed killer, and filled with an asphalt-based crack filler (large cracks may require several applications). For best quality, it is recommended that all broken asphalt be removed and patched with new asphalt. It is also suggested that extreme low spots be filled with new asphalt.

4. New asphalt pavement should cure 30 days before application of seal coat. If Pavement must go into service prior to the required 30-day cure time, temporary striping for all areas affected shall be provided at no additional cost.

5. Immediately before commencing the seal coat operations, all surface metal utility covers (including survey monuments) shall be protected by thoroughly covering the surface with an appropriate adhesive and oiled or plastic paper. No adhesive material shall be permitted to cover, seal or fill the joint between the frame and cover of the structure. A vertical tab shall be placed on each cover for locating after the seal application is complete. The tab shall extend at least 3" above the existing pavement surface. Covers are to be uncovered and cleaned of asphalt emulsion material by the end of the same work day. Inspector shall inspect surfaces before the installation of seal coat.

6. For best results, the asphalt, just prior to being sealed, should be sprayed with a mist of water in an amount that will leave the surface damp but with no puddles or visible water. This procedure is critical when ambient temperature is hot with bright sunlight or when the pavement is excessively aged or porous.

7. A prime or tack coat may be necessary on surfaces that have weathered excessively or are dusted. The primer should be diluted with three parts clean, potable water and one part SS-1h emulsion and shall be applied at the rate of 0.05 gallon per square yard.

8. Install barricades as required to divert traffic from operations. Install temporary "no parking" signs and similar notices.

B. Application:

1. Seal coat may be mixed with water to obtain desired consistency for job requirements to a maximum of 20% of the total volume. Care should be taken not to over dilute. Material after dilution shall be mixed with a mechanical agitator to maintain consistency and ease of application. Note that as the pavement increases in roughness, the amount of dilution should be decreased.

2. Seal coat shall only be applied when the atmospheric temperature is greater than 55 degrees F and if rain is not forecast for the period of 24 hours after application.

3. The seal coat material shall be applied in two applications. Unless otherwise specified, the total quantity applied (before dilution) shall be 50 gallons per 1,000 square feet.

4. Seal coat material shall be applied using a truck-mounted tank or wheeled container in continuous parallel lines and spread by means of brooms or rubber-faced squeegees either by hand or machine and in such a manner as to eliminate all ridges, lap marks, and air pockets.

5. Hand tools shall be available in order to remove spillage. Ridges or bumps in the finished surface will not be permitted. Seal coat material shall be homogeneous prior to spreading, with no visible separation of solids and liquids.

6. When the first coat has completely dried to the touch, apply the second coat. While misting is not normally required before second coat, surface should be clean with no foreign materials on it.

C. Drying Time:

1. Seal coat should be allowed to dry 24 – 48 hours before permitting traffic. When asphalt is cold or in shade, or air temperature is below 75 degrees F, based on general weather, humidity and temperature conditions, drying time may need to be extended.

3.02 CLEAN UP

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

B. Striping for parking or traffic flow should be done only after the seal coat has thoroughly dried. It is recommended that a high quality water based Traffic Line Paint be used for best results.

3.03 PROTECTION

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

END OF SECTION

SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing, placing, spreading, compacting and shaping jointed plain portland cement concrete pavement with weakened plane, contact and isolation joints, for vehicular traffic.

B. Form construction and use in placing portland cement concrete pavement.

C. Joints for portland cement concrete pavement.

D. Finishing portland cement concrete pavement.

E. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

A. Section 32 11 00 – Pavement Base Courses.

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Refer to Geotechnical Consultant.

B. AASHTO Standard Specifications
1. T 53: Softening Point of Bitumen (Ring-and-Ball Apparatus)

C. ASTM Standards
1. A 615: Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. A 706: Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
3. A 775: Epoxy-Coated Steel Reinforcing Bars.
4. A 884: Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
5. A 934: Epoxy-Coated Prefabricated Steel Reinforcing Bars.
6. A 996: Rail-Steel and Axle Steel Deformed Bars for Concrete Reinforcement.
7. C 309: Liquid Membrane-Forming Compounds for Curing Concrete.
8. C 881: Epoxy-Resin-Base Bonding Systems for Concrete.
9. C 1107: Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
10. D 994/01751: Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
11. D 2628: Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
12. D 2835: Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
13. D 3405/6690: Joint Sealants, Hot Applied, for Concrete and Asphalt Pavement
14. D 3963: Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing
15. D 5249: Backer Material for Use with Cold and Hot Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints.

D. Caltrans Standard Specifications:
1. Section 40, Portland Cement Concrete Pavement.

2. Section 52, Reinforcement.
3. Section 90, Portland Cement Concrete.
4. Section 95, Epoxy.

E. Caltrans Standard Plans:
1. Plan P1: Jointed Plain Concrete Pavement.
2. Plan P10: Concrete Pavement – Dowel Bar Details.
3. Plan P18: Concrete Pavement – Lane Schematics and Isolation Joint Detail.
4. Plan P20: Concrete Pavement – Joint Details.

1.4 DEFINITIONS

A. ASTM: American Society for Testing and Materials.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer must be certified according to the National Ready Mix Concrete Plant Certification Program.

B. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer’s plant and each aggregate from one source.

D. Portland Cement concrete paving and concrete finishes: Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.

1.6 SUBMITTALS

A. Submit under provisions of Division 01.

B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.

C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compound.
5. Preformed compression joint sealant.
6. Bonding agent of adhesive.
7. Joint filler.
8. Joint sealant.
9. Tie bars.
10. Dowel bars.
11. Epoxy.

12. Backer rods

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete material shall comply with ASTM C94, ready-mixed concrete.

B. Poured-in-place concrete: All slabs and steps shall be Class A conforming to Section 90 of State Specifications with a 28 day compressive strength in excess of 3000 psi. Cement: Type V modified conforming to ASTM-C-150, Portland cement.

C. Aggregate – ASTM C33, Maximum size ¾-inch diameter, clean, limestone free of materials causing stains; use natural sand for fine aggregate.

D. Water: Clean, free from injurious amounts of oil, alkali, organic matter or other deleterious matter detrimental to concrete.

E. Expansion Joints: Homex 300 wood fiber strip (non-asphaltic) or approved equal. Fill thickness of slab, 3/8" thick.

2.2 CONCRETE MIX – BY PERFORMANCE CRITERIA

A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.

B. Select proportions for normal weight concrete in accordance with ACI 301.

C. Provide concrete to the following criteria:
1. Compressive Strength: 3,000 psi at 28 days
2. Slump: 4 inches
3. Minimum Cement Ratio: 5 sack
4. Maximum Water-Cement Ratio at point of placement: 0.45 to 0.50
5. For vehicular accessible areas use concrete with a minimum cement ratio of 6 sack, 4" slump, and 3500 psi at 28 days

Plans note 3500 psi for all pavement, .. Clarify intent

2.3 TIE BARS

A. Deformed Reinforcing Steel Bars: ASTM Designation A 615, Grade 40 or 60; A 996, Grade 50 or 60; or A 706.

B. Epoxy Coating: ASTM Designation A 934 or A 775 and Caltrans Standard Specification Section 52-1.02B. Thickness to be 7 to 16 mils after curing.

C. Fabrication, Sampling and Jobsite Handling: ASTM Designation D 3963 and Caltrans Standard Specification Section 52-1.02B, except samples for testing are not required.

D. Do not bend tie bars.

2.4 EPOXY FOR BONDING TIE AND DOWEL BARS TO CONCRETE

A. Two component epoxy-resin conforming to ASTM Designation C 881, Type V, Grade 3 (None sagging), Class A, B or C as follows:
   1. Class A: Internal temperature of concrete is below 40 degrees F, but not lower than recommended by the manufacturer.
   2. Class B: Internal temperature of concrete is 40 degrees F to 60 degrees F.
   3. Class C: Internal temperature of concrete is above 60 degrees F, but not higher than recommended by the manufacturer.

B. Submit the following to the Owner's Representative:
   1. A certificate from the manufacturer that the epoxy meets the requirements of the Plans and Specifications.
   2. A copy of the manufacturer's recommended installation procedure at least 7 days prior to the start of the work.

2.5 DOWEL BARS

A. Plain round smooth, epoxy-coated steel and free from burrs and other deformations detrimental to free movement of the bars in the concrete. Conform to ASTM A 615, Grade 40 or 60, and Caltrans Standard Specification Section 52-1.02B, except that the samples for testing shall not be required.
   1. Epoxy Coating: ASTM Designation A 884, Class A, Type 1 or 2, except that the bend test is not required.

2.6 BOND BREAKER

A. White pigmented curing compound or factory applied Petroleum paraffin based lubricant as follows:
   1. A copy of the manufacturer's recommended installation procedure at least 7 days prior to the start of the work.
   2. A copy of the manufacturer's recommended installation procedure at least 7 days prior to the start of the work.
      a. Dayton Superior DSC BB-coat or equal.
      b. Valvoline Tectyl 506 or equal.

2.7 JOINT SEALANT

A. See Section 32 13 73.

2.8 HYDRAULIC CEMENT GROUT

A. Material: ASTM Designation D 1107 or:

B. At the Contractor's option, clean, uniformly rounded aggregate filler may be used to extend the grout. The extension of grout shall not exceed 60 percent of the weight of the grout or the maximum amount of grout extension recommended by the manufacturer, whichever is less. The moisture content of the aggregate filler shall not exceed 0.5-percent. Grading of the aggregate filler shall conform to the following:

Sieve Size	Percentage Passing
1/2 inch	100
3/8 inch	85 - 100
No. 4	10 - 30
No. 8	0 - 10
No. 16	0 - 5

PART 3 - EXECUTION

3.1 WATER SUPPLY

A. Conform to Section 40-1.02 of Caltrans Standard Specifications.

3.2 SUBGRADE

A. Conform to Section 40-1.04 of Caltrans Standard Specifications.

3.3 SOIL STERILANT

A. Furnish and apply to areas indicated in accordance with Section 32 12 16.

3.4 PLACING

A. Conform to Section 40-1.06 of Caltrans Standard Specifications.

3.5 SPREADING COMPACTING AND SHAPING

A. Conform to Section 40-1.07 of Caltrans Standard Specifications.
   1. Stationary Side Form Construction: Section 40-1.07A of Caltrans Standard Specifications.
   2. Slip Form Construction: Section 40-1.07B of Caltrans Standard Specifications.

3.6 INSTALLING TIE BARS

A. General: Install in accordance with Caltrans Standard Plan P1.

B. Drill and Bond: Bond with a two-component, epoxy-resin conforming to this section. Clean and dry drilled holes in conformance with the epoxy manufacturer's instructions. Rotate tie bars 180 degrees while inserting into the drilled holes. Support tie-bars to prevent movement during curing. Improperly placed, or bonded tie bars will be rejected by the Owner's Representative and corrective measures approved by the Owner's Representative shall be at the Contractor's expense.

C. Apply epoxy in conformance with the manufacturer's recommendations.

D. Inserting into Plastic Concrete: Provide full contact between the tie bar and the concrete. Rework and refinish the concrete over the tie bars. Replace loose tie bars by drilling and bonding at the Contractor's expense.

E. Threaded Couplers: Fabricate Couplers from deformed bar reinforcement material, free of external welding and machining. Provide a certificate that the coupler meets the requirements of these specifications. Install the couplers in conformance with the manufacturer's instructions.

3.7 INSTALLING DOWEL BARS

A. General: Install in accordance with Caltrans Standard Plan P1, except that location and spacing shall not be as shown on Plan P10, but shall be as indicated.

B. Completely coat dowel bars with a bond breaker prior to placement. If curing compound is used, apply in two separate applications. The last application shall not be more than 8 hours prior to the placement of the dowel bars. Apply each application of curing compound at the approximate rate of one gallon per 15 square yards

C. Apply epoxy in conformance with the manufacturer's recommendations.

3.8 JOINTS

A. General: Construct contact joints, longitudinal and transverse weakened plane joints and isolation joints in accordance with Caltrans Standard Plan P1, P10, P18 and P20 and Caltrans Standard Specification Section 40-1.08, except that location, spacing and angle shall not be as indicated on Plan P1or in Caltrans Standard Specification Section 40-1.08, but shall be as indicated. Unless noted otherwise longitudinal and transverse weakened plane joints shall be Type B as detailed on Caltrans Standard Plan P20. Conform weakened plane joints to Caltrans Standard Specification Section 40-1.08B.

B. Upon completion of the work of this Section, remove all surplus materials, rubbish and debris from the premises.

C. Cleaning and Finishing: Upon completion, clean all exposed surface, removing any discoloration or foreign matter. Touch-up abraded or cut areas and exposed edges with finishing material recommended by the manufacturer. Touch-up shall not be obvious.

3.9 FINISHING

A. Conform to Sections 40-1.09 and 40-1.10 of Caltrans Standard Specifications.

3.10 CURING

A. Conform to Section 40-1.11 of Caltrans Standard Specifications.

3.11 LIQUID JOINT SEALANT INSTALLATION AT WEAKENED PLANE JOINTS

A. General: See Section 32 13 73.

3.12 CONSTRUCTING CONTACT JOINTS

A. Conform to Caltrans Standard Specification Section 40-1.08A and the following:
   1. Construct at the end of each days work or where concrete placement is interrupted for more than thirty minutes to coincide with the next regular joint location.
   2. Provide a metal or wooden bulkhead (header), designed to accommodate the installation of dowel bars, to form the joint.

3.13 CONSTRUCTING ISOLATION JOINTS

A. Do not place tie bars or dowels across isolation joints.

B. Secure joint filler to the face of the existing concrete by a method that will hold the joint filler in place and prevent the new concrete from adhering to the existing concrete, during placement of concrete.

C. Place isolation joint sealant of the type indicated in conformance with the requirements for liquid joint sealant installation as specified above, except references to backer rods shall not apply.

3.14 CONSTRUCTING WEAKENED PLANE JOINTS

A. Conform to Caltrans Standard Specification Section 40-1.08B and the following:

B. Lighter weight saws (early entry saws) specifically designed for sawing fresh concrete without the use of water may be used to construct weakened plane joints. Early entry saws shall be capable of sawing joints within 2 hours of cure time after concrete placement without raveling or tearing, as defined in Caltrans Standard Specification Section 40-1.08B(1). Groves sawed with early entry saws shall be cut to a maximum of 0.12-inch in width. The minimum depth of cut shall be calculated utilizing the formula in Caltrans Standard Specification Section 40-1.08B(1), except d=t/4.

C. Joints sawed with early entry saws that develop random cracking shall be removed to the nearest joint and replaced with concrete containing dowel bars and tie bars. The removal and replacement work shall be at the Contractors expense.

D. Weakened plane joints not sawed within 2-hours of placing concrete shall be sawed by conventional power driven wet type concrete saws in conformance with the requirements of Caltrans Standard Specification Section 40-1.08B(1).

3.15 PROTECTING CONCRETE PAVEMENT

A. Conform to Section 40-1.12 of Caltrans Standard Specifications.

END OF SECTION 321313

SECTION 321723 – PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Removal of existing traffic stripes and pavement markers.

B. Removal of existing signs.

C. Cleaning and sweeping of streets before application of traffic stripes and pavement markings.

D. Materials and application for traffic stripes and pavement markings.

E. Materials and application for pavement markers.

F. Traffic control signs and street name signs.

G. Object markers.

H. Survey monuments.

I. Accessible Parking

1.2 RELATED SECTIONS

A. Section 32 12 16 – Asphalt Paving.

B. Section 32 13 13 – Concrete Paving.

1.3 RELATED DOCUMENTS

A. Caltrans Standard Specifications:

1. Section 56, Signs.
2. Section 81, Monuments.
3. Section 82, Markers and Delineators.
4. Section 84, Traffic Stripes and Pavement Markings.
5. Section 85, Pavement Markers.

B. Caltrans Standard Plans:

1. Plan A20A through A20D: Pavement Markers and Traffic Lines, Typical Details.
2. Plan A24A and A24B: Pavement Markings Arrows.
3. Plan A24C: Pavement Markings, Symbols and Numerals.
4. Plan A24D: Pavement Markings, Words.
5. Plan A24E: Pavement Markings, Words and Crosswalks.

6. Plan A73A: Object Markers.
7. Plan A73B: Markers.
8. Plan A74: Survey Monuments.
9. Plan RS1: Roadside Sign, Typical Installation Details No. 1.
10. The State of California Traffic Manual, edition in effect at time of date on plans.
11. The regulations, standards, and tests of the State of California Department of Transportation Materials and Research Division, edition in effect at time of date on plans.

1.4 QUALITY ASSURANCE

A. Deliver certificates showing conformance with this specification to the Owners Representative with each shipment of materials and equipment to the Project site.

1.5 PROJECT CONDITIONS

A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the Owners Representative.

B. Thoroughly cure new asphalt concrete and portland cement concrete before application of stripes, markings or markers.

PART 2 PRODUCTS

2.1 THERMOPLASTIC STRIPES AND MARKING

A. Conform thermoplastic striping and marking materials to Section 84-2.02 of Caltrans Standard Specifications, unless noted otherwise herein or on the Plans.

2.2 PAINTED STRIPES AND MARKINGS

A. Conform painted striping and marking materials to Section 84-3.02 of Caltrans Standard, Specifications, unless noted otherwise herein or on the Plans.

2.2 PAVEMENT MARKERS

A. Types: Section 85-1.02 of Caltrans Standard Specifications and as indicated.

B. Sampling, Tolerances and Packaging: Section 85-1.03 of Caltrans Standard Specifications.

C. Material:

1. Non-reflective: Section 85-1.04 of Caltrans Standard Specifications.
2. Retroreflective: Section 85-1.05 of Caltrans Standard Specifications.

2.3 TRAFFIC CONTROL SIGNS

A. General: Section 56-2 of the Caltrans Standard Specifications.

B. Sign Panels: Conform type (regulatory or warning), size, shape and pattern to the State of California, Department of Transportation, Traffic Manual, edition in effect at the date of the Plans. Sign faces to be of reflectorized porcelain enamel.

C. Posts:

1. Metal: Two (2) inch inside diameter steel pipe. Conform to Section 56-2.02A of Caltrans Standard Specifications, unless otherwise specified.

2. Wood: Conform to Section 56-2.02B.

D. Mounting Hardware: Section 56-2.02D of Caltrans Standard Specifications, unless otherwise specified.

E. Post Foundations: Concrete Paving conforming to Section 32 13 13.

2.4 STREET NAME SIGNS

A. Conform to manufacturer, style, size, and shape shown on the Plans.

B. Posts: Two (2) inch inside diameter steel pipe unless noted otherwise on the Plans. Conform to Section 56-2.02A of Caltrans Standard Specifications.

C. Post Foundations: Concrete Paving conforming to Section 32 13 13.

2.5 REFLECTORIZED OBJECT MARKERS

A. Reflectorized Metal Object Markers: Conform to the applicable requirements of Section 82 of Caltrans Standard Specifications for target plates and reflectors, and Caltrans Standard Plan A73A for type L-1 or L-2 object markers.

B. Posts: Metal posts conforming to the applicable requirements of Section 82-1.02B of Caltrans Standard Specifications and Caltrans Standard Plan A73B.

C. Mounting Hardware: Conform to the applicable requirements of Section 82-1.02G of Caltrans Standard Specifications.

2.6 STREET SURVEY MONUMENTS

A. General: Conform to Section 81-1.02 of Caltrans Standard Specifications, except that the marker disk will not be furnished. Marker disk shall be 2-inch diameter solid brass with a 2-3/4-inch shaft, “Lietz No. 525” or equal.

1. Concrete Paving: Section 321313.

2.7 ACEESIBLE PARKING

A. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance complying with CBC Section 11B-208.3.1.

B. Accessible parking spaces serving more than one accessible entrances shall be dispersed and located on the shortest accessible route to the accessible entrances.

C. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. CBC Section 11B-208.3.1.

D. Minimum number of required accessible parking spaces shall be provided in accordance with CBC Table 11B-208.2 for each parking spaces, at least one shall be an accessible van parking space. CBC Section 11B-208.2.4.

E. Accessible parking spaces and access aisles shall comply with CBC Section 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:
   1. Parking spaces and access aisles shall be marked according to CBC Figures 11B-502.2, 11B-502.3, and 11B-502.3.3. Their surfaces shall comply with CBC Section 11B-302 and shall be at the same level with slopes not steeper than 1:48 in any direction. CBC Section 11B-502.4
   2. Parking spaces shall be 9'x18' minimum and van parking spaces shall be 12'x18' minimum with an adjacent access aisle of 4' 18' minimum. Access aisles shall be placed on either side of the parking spaces except to be located on the passenger side for van parking spaces. Van parking spaces shall be permitted to be 9'x18' minimum where the access aisle is 8'x18' minimum.
   3. Access aisles shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CBC Section 11B-502.3.3.
   4. Access aisles (accessible parking spaces as well - similar application) shall not overlap the vehicular way. CBC Section 11B-502.3.4.
   5. A vertical clearance of 8'-2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. CBC Section 11B-502.5.

F. Passenger Drop-off and Loading Zones:
   1. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone spaces, or fraction thereof, complying with CBC Sections 11B-209 and 11B-503 as follows:
      - Vehicle pull-up spaces shall be 8' x20' minimum.
      - Access aisles shall be 5' wide minimum x full length of vehicle pull-up spaces they serve and shall be adjacent and parallel to the vehicle pull-up spaces. They shall be at the same level with each other and with slopes not steeper than 1:48 in any direction. Access aisles shall adjoin in accessible route and shall not overlap the vehicular way.
      - Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with surface. (Blue interior hatch lines are preferred for concrete surfaces and white interior line shall be interrupted at 12" high 'No Parking' text so that legibility is maintained.) CBC Section 11B-503.5.
   2. Bus Loading Zones:
      - Bus loading and bus stops shall comply with CBC Sections 11B-209 and 11B-810.2 as follows:
        - Bus boarding and alighting areas shall be of 8'x5' minimum, with 8' measured perpendicular to the curb or vehicle roadway edge, and with 5' measured parallel to the vehicle roadway. Sloped in 8' direction shall be 1:48 maximum. Slopes in 5' direction shall be the same as the roadway, to the maximum extent practicable. CBC Figure 11B-810.2.2
        - Bus shelters shall provide a minimum 30" x 48" clear floor or

ground space (36" x 48" or 36" x 60” in an alcove per *CBC f j B-J05.* 7), with slopes not steeper than 1 :48 in any direction, entirely within the shelter com plying with *CBC Section 11B-305.*

- Bus shelters shall be connected by an accessible route complying with CBC Section *11B-402* to a boarding and alighting area com plying with *CBC Section 11B-810.2 and Figure 11B-810.3.*
- Newly constructed bus stop boarding and alighting areas shall provide a detectable transition between the boarding/alighting area and the roadway; the detectable transition shall consist of a curb with the face sloped at 35 degrees maximum from vertical or detectable warnings com plying with CBC Section 11B-705.1.1 and 11B-705. 1.2.4.

G. Electrical Vehicle Charging Stations:
   1. Where Electric Vehicle Charging Stations are provided, they shall be provided in accordance with CBC Section 11B-228.3, Table 11B-228.3.2. 1 and CBC Section 11B- 812 (see 26 26 53 Electric Vehicle Charging Equipment for additional requirements).
   2. Accessibility requirements for Public Use or Common Use EVCS facilities:
      - Vehicle spaces and access aisles serving them shall comply with CBC Section 11B-302. Access aisles shall be at the same level as the vehicle space they serve. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted in vehicle spaces and access aisles. CBC Section 11B-812.3
      - Vehicle spaces, access aisles serving them and vehicular routes serving them shall provide a vertical clearance of 98 inches minimum. CBC Section 11B-812.4
      - Accessible routes between EVCS parking, equipment and the building or facility served shall be provided per CBC Section 11B-812.5
      - Vehicle spaces for van accessible, standard accessible, ambulatory and drive-up EVCS shall meet minimum length and width requirements per CBC Section 11B-812.6. All EVCS stalls shall be marked "EV Charging Only” per CBC Sect/or› 11B-812.9 and Figure 11B-812.9.
      - Access aisles for van accessible and standard accessible EVCS shall meet minimum length and width requirements and be marked per CBC Section 11B-812.7 the color of the perimeter, hatch lines and “No Parking" letters shall contrast with the surface color (blue color required for use at non-EVCS accessible parking shall no/ be used).
      - Where four or fewer total EVCS are provided, identification with an International Symbol of Accessibility (ISA) shall not be required. Where five to twenty-five total EVCS are provided, one van-accessible EVCS shall be identified with an ISA complying with section CBC Section 11B-703.T.2.1. The required standard accessible EVCS shall not be required to be marked with an ISA. Where twenty- six or more EVCS are provided, all required van-accessible and all required standard accessible EVCS shall be identified with an ISA. The required ISA identification sign shall be reflective with a minimum 70 square inches, shall be visible from the EVCS it serves. The sign shall be permanently posted either

immediately adjacent to the vehicle space or within the projected vehicle space at the head end of the vehicle space. Signs identifying van accessible vehicle spaces shall contain the designation “Van Accessible”. Signs shall be minimum 60" above the finish surface except that if the sign projects into a pedestrian circulation area, they shall be minimum 80” above finish surface. CBC Section 11B-812.8

- Ambulatory EVCS com plying with *CBC* Section *11B-812.6.3* shall be required where 26 or more EVCS are provided. CBC *Table 11B-228.3.2.1*

PART 3 EXECUTION

3.1 REMOVAL OF TRAFFIC STRIPES, PAVEMENT MARKINGS AND PAVEMENT MARKERS

A. Where blast cleaning is used for the removal of painted traffic stripes and pavement markings, or for removal of objectionable material, remove the residue, including dust and water, immediately after contact with the surface being treated. Remove by a vacuum attachment operating concurrently with the blast cleaning operation.

B. Where grinding is used for the removal of thermoplastic traffic stripes and pavement markings; remove the residue by means of a vacuum attachment to the grinding machine. Do not allow the residue to flow across or be left on, the pavement.

C. Where markings are to be removed by blast cleaning or by grinding, the removed area shall be approximately rectangular so that no imprint of the removed marking remains on the pavement.

D. Contractor will be responsible for repairing any damage to the pavement during removal of pavement markers. Damage to the pavement, resulting from removal of pavement markers, shall be considered as any depression more than 1/4-inch deep.

3.2 TEMPORARY PAVEMENT MARKERS

A. If permanent pavement markers cannot be installed immediately, and the street or road is to be placed in service, install short term, temporary pavement markers on the new pavement prior to opening the street or road to traffic.

B. Place markers at a maximum of 24 feet on centers or as required by the governmental agency having jurisdiction, in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways.

3.3 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Section 84-2.04 of Caltrans Standard Specifications and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.4 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Section 84-3.03, 3.04 and 3.05 of Caltrans Standard Specifications and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.5 PAVEMENT MARKERS

A. Place in conformance with the requirements of Section 85-1.06 of the Caltrans Standard Specifications.

B. Pavement recesses are not required. Markers shall be installed accurately to the line established by the Engineer. No markers shall be installed until the surface has been approved by the Owner’s Representative.

3.6 TRAFFIC CONTROL SIGNS

A. Install in conformance with Sections 56-2.03 and 2.04 of Caltrans Standard Specifications, Caltrans Standard Plan RS1, the applicable requirements of the State of California Department of Transportation Maintenance Manual and the details shown on the Plans. The horizontal locations shown on Caltrans Standard Plan RS1shall not be applicable, the horizontal location shall be as shown on the Plans.

B. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

C. After erection, damage to traffic sign faces shall be touched up or the sign replaced.

3.7 STREET NAME SIGNS

A. Install in accordance with the manufacturer’s instructions and as shown on the Plans.

B. Horizontal location shall be as shown on the Plans.

C. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

3.8 REFLECTORIZED OBJECT MARKERS.

A. Install in conformance with the requirements of Section 82-1.03 of Caltrans Standard Specifications, except that the metal marker posts shall not be driven in place without prior approval of the Owner’s Representative.

B. Install at locations shown on the Plans.

3.9 STREET SURVEY MONUMENTS

A. General: Conform to Section 81-1.03 of Caltrans Standard Specifications and Caltrans Standard Plan A74, except that the marker disk will not be furnished. Exact point in marker to be determined by an accurate survey and clearly punched

in top of marker together with California Registered Civil Engineer's or California Licensed Land Surveyor's license number.

3.10 PROTECTION

A. Protect the newly installed traffic stripes and pavement markings from damage until the material has cured.

B. Replace any traffic stripes or pavement markings or markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

3.11 RESTORATION OF EXISTING IMPROVEMENTS

A. Existing signs, striping or other markings removed or damaged due to the installation of new facilities shall be replaced in kind.

B. Existing landscaping or planting removed, damaged or disturbed due to the installation of traffic control signs or street name signs shall be replaced in kind.

END OF SECTION

SECTION 321726 – TACTILE WARNING SURFACING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Embedded tactile warning surface tile, with an inline dome pattern, for application on ramps and level walking surfaces.

B. Tactile Tile Installation Method: As indicated on Drawings, and as follows:.

1. New Concrete: Installation in cast-in-place uncured (wet) concrete.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete.

1.3 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. AASHTO HB-17 – Standard Specifications for Highway Bridges.
2. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
3. ASTM C293 – Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading).
4. ASTM C1028 – Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
5. ASTM D543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
6. ASTM D570 – Standard Test Method for Water Absorption of Plastics.
7. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
8. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics.
9. ASTM D1037 – Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
10. ASTM D2486 – Standard Test Methods for Scrub Resistance of Wall Paints.
11. ASTM D5420 – Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
12. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
13. ASTM G155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Shop Drawings: Show detailed plans of tile profile, fastener locations, and installation methods.

C. Samples: Furnish two tile samples, minimum 8 inches by 8 inches in size, of the type and color specified in this Section.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm specializing in manufacturing products specified in this Section with a minimum five years' experience.
B. Detectable waring surfaces shall comply with CBC Section 11B-705.1.
C. Detectible waring surfaces at transit boarding platforms edges, bus stops, hazardous vehicular areas, reflecting pools, and track crossings shall be yellow and approximate FS 33538 of Federal Standard 595C. Detectable waring surfaces at other locations shall be either the aforementioned yellow or a color providing a 70 percent minimum visual contrast with that of adjacent walking surface. The material used to provide visual contrast shall be an integral part of the surface. CBC Section 11B-705.1.1.3
D. Detectable waring surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. Such constraint shall be required for detectable warning surfaces at curb ramp, islands, or cut-through medians. CBC Sections 11B-705.1.1.4

1.6 REGULATORY REQUIREMENTS

A. General: Provide detectable (tactile) warning products in accordance with California Code of Regulations (CCR). Title 24, Part 1, 2013 California Administrative Code, Chapter 5 "Access to Public Buildings by Persons with Disabilities."

1. Article 2 "Division of the State Architect – Access Compliance Processing Product Approvals."
2. Article 3 "Acceptance of Detectable Warning and Directional Surface Products for Manufacturers and Design Professionals."
3. Article 4 "Application for Independent Entity Evaluation Approval (IEEA)."

B. Definition of Detectable Warning: Conform to 2013 California Building Code, Chapter 2 "Definitions," Section 202 "Definitions."

1. Chapter 11B "Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing," Section 11B-106.5 "Defined Terms" for detectable warning.

C. Detectable Warnings for Site Accessibility: Provide detectable warning system in accordance with 2019 California Building Code, Chapter 11B, "Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing", Section 11B-705.1, Section 11B-705.1.1.4, and the following:

1. Detectable Warnings at Curb Ramps: Chapter 11B, Section 11B-206 "Accessible Routes", Section 11B-406.5.12, "Detectable Warnings", and Section 11B-705.1.2.2, "Curb Ramps".
2. Detectable Warnings at Hazardous Vehicular Areas: Chapter 11B, Section 11B-206, "Accessible Routes", Section 11B-406.5.12, "Detectable Warnings", and Section 11B- 750.1.2.5, "Hazardous Vehicular Areas".

D. Warranty: Provide minimum 5 year warranty per DSA Bulletin 10/31/02, revised 04/09/08.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle packaged products in original containers with seals unbroken and labels intact until the time of installation.

B. Store delivered products in a clean, safe, dry area.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of Design Product: Armor-tile by Engineered Plastics Inc., Williamsville, NY; 800-682- 2525, http://www.armor-tile.com.

1. Provide Cast-In-Place Type Armor-Tile for embedding in cast-in-place uncured (wet) concrete.

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Tactile Warning Tiles: An epoxy polymer composite with an ultraviolet stabilized coating containing aluminum oxide particles in the truncated domes.

1. Cast-In-Place Type Tile for Embedding in Cast-In-Place Uncured (Wet) Concrete:
   a. Tile thickness to be 0.3875 inch at domes and 0.1875 inch in flat areas between domes. Total thickness at perimeter to be 1.375 inches; dome height to be 0.20 inch.
   b. Tile underside to have embedment flanges with 0.625-inch diameter holes; long sides to have 0.1875-inch diameter vent holes.
   c. Tile to have sound amplifying plastic plates attached between flanges, with an air space between tile bottom surface and sound amplifying plastic plates.
   d. Tile face to have non-slip texture.

B. Color and Size:

1. Safety Yellow, (Federal Color #33538) colorfast, UV stabilized coating. Color shall be uniform throughout the tile.
2. Sizes: As indicated on Drawings.

C. Performance Requirements: Tactile warning tiles shall meet or exceed the following criteria:

1. Water Absorption: 0.05 percent, maximum, when tested in accordance with ASTM D570.
2. Slip Resistance: 0.80, minimum combined wet/dry static coefficient of friction on top of domes and field area, when tested in accordance with ASTM C1028.
3. Compressive Strength: 28,000 psi, minimum, when tested in accordance with ASTM D695.
4. Tensile Strength: 19,000 psi, minimum, when tested in accordance with ASTM D638.
5. Flexural Strength: 25,000 psi, minimum, when tested in accordance with ASTM C293.
6. Gardner Impact: 550 inch-pounds per inch minimum, when tested in accordance with ASTM D5420.
7. Chemical Stain Resistance: No discoloration or staining when exposed to ten percent hydrochloric acid, urine, saturated calcium chloride, black stamp pad ink, chewing gum, red aerosol paint, ten percent ammonium hydroxide, one percent soap solution, turpentine, five percent Urea, diesel fuel, motor oil, and tested in accordance with ASTM D543.
8. Wear Depth: 0.06 inch, maximum, after 1000 abrasion cycles of 40 grit Norton Metallite sandpaper, tested in accordance with ASTM D2486.
9. Flame Spread: 15 maximum, when tested in accordance with ASTM E84.

10. Accelerated Weathering: No deterioration, fading or chalking, when tested for 3,000 hours in accordance with ASTM G155.
11. Accelerated Aging and Freeze Thaw Test of Tile and Adhesive System: No cracking, delamination, warping, checking, blistering, color change, loosening of tiles, or other detrimental defects, when tested in accordance with ASTM D1037.
12. Salt and Spray Performance: No evidence of deterioration or defects after 200 hours of exposure, when tested in accordance with ASTM B117.
13. AASHTO HB-17 Single Wheel HS20-44 Loading Test for Cast-In-Place Type Tile: Mounted on concrete platform with 1/2 inch air space at the underside of tile and subjected to a maximum load of 10,400 pounds, corresponding to 8000 pound individual wheel load and thirty percent impact factor; no visible damage at maximum loading.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install tactile warning surface tiles in accordance with manufacturer's printed instructions.

B. Install Cast-In-Place Type tiles over cast-in-place, uncured (wet) concrete.

C. Ensure that the surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation.

D. Installation in Cast-In-Place Uncured (Wet) Concrete: Maintain concrete in 4 inch to 7 inch slump range. Lay tactile warning surface tiles (without removing protective plastic wrap) in uncured (wet) concrete and tamp each tile in place. Place weights over tiles to prevent floating, as recommended by the manufacturer. After curing, remove protective plastic wrap, and clean tile surfaces.

END OF SECTION

SECTION 32 31 00

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide chain link fence and gates with framing and fabric, gate hardware, and accessories for complete installation.

1. Provide galvanized steel or aluminum coated steel chain link fence and gates.
2. Excavate for post bases and provide concrete anchorage for posts.

B. Related Work:

1. Section 01 50 00: Temporary construction fence.

1.2 REFERENCES

A. Chain Link Fence Manufacturer's Institute (CLFMI): Chain Link Fence Installation Standard.

B. ASTM F567: Installation of Chain Link Fence.

1.3 SUBMITTALS

A. Product Data: Submit product literature, including standard details.

B. Shop Drawings: Indicate plan layout, grid, spacing of components, accessories, and anchorage.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Ameristar Fence Products.

B. Master Halco, Inc.

C. Iron World Manufacturing.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide chain link fence and gates with framing and fabric, gate hardware, and accessories.

1. Provide complete system from single manufacturer including framing, fabric, and accessories.

2. Automatic Gate Operators: Provide operators including accessories. Automatic gate operators may be from different company.

B. Framework: Design fence framework to comply with strength requirements conforming to ASTM F1043; ASTM A1083, Schedule 40, butt weld, standard weight, hot dip galvanized to 1.8 oz/sf coating; Type I weight.

1. Line Posts, Corner Posts, Terminal Posts, Caps, Brace Rails:

a. End, Corner and Pull Posts: Minimum 2.875" outside diameter, and 5.79 pounds per linear foot.

b. Rails and Braces: Minimum 1.66", 1.35 lbs/lin. ft.

c. Caps: Galvanized castings as approved by Architect and as appropriate for applications specified.

d. Gate Posts: Minimum 4" outside diameter; 9.1 lbs/lin. ft.

2. Types and Sizes: As indicated, where not indicated, sizes as recommended by manufacturer.

a. Fence Height: 8'-0", unless otherwise indicated.

3. Fittings: Provide sleeves, bands, clips, rail ends, tension bars, fasteners, fittings, tie wire, and accessories as required for complete installation.

C. Fabric: 2" diamond mesh, interwoven, 9-gage top selvage twisted tight, bottom selvage knuckle end closed; one-piece fabric widths unless fence height exceeds maximum available width.

1. Mesh: ASTM A392 Class 2, zinc-coated steel, or ASTM A428 aluminum coated steel, minimum 0.40 oz/sf coating.

2. Plastic Coating: ASTM F668, minimum Class 2a extruded and adhered or Class 2b fusion bonded PVC coating on minimum 0.3 oz/sf zinc coated steel wire or comparable aluminum coated steel wire.

a. Color: As indicated, as selected by Architect from manufacturer's full range of colors where not otherwise indicated.

D. Tension Wire: Minimum 7-gage galvanized steel single strand or comparable aluminum coated steel.

E. Plastic Coating: Manufacturer's standard virgin polyvinyl chloride (PVC) vinyl coating; Shore D hardness of 40 to 60; bond of coating to metal to be greater than or equal to cohesive strength of vinyl.

1. Coat factory cut ends with same vinyl material.

2. Color: As indicated, as selected by Architect from manufacturer's full range of colors where not otherwise indicated.

3. Where plastic coating is indicated provide coating on fence components other than gate hardware; provide plastic coating on gate hardware where required hardware is available with plastic coating matching coating on gates.

F. Privacy Slats: Polyethylene tubular slats, not less than 0.23” thick, manufactured from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated, and with bottom lock strips.

1. Color: As indicated, as selected by Architect from manufacturer’s full range of colors where not otherwise indicated.

G. Barbed Wire: Minimum two strand, 12-1/2-gage wire with 14-gage four point barbs spaced not more than 5" on center; metal and finish to match fence fabric.

1. Supports: ASTM F626, double "V" arm type for triple strands with each arm at 45-degrees typical; provide straight vertical support at gates; finish to match framework.

H. Ribbon Wire: Continuous helical coils of barbed stainless-steel tape, fabricated from 0.025" thick by 1" wide austenitic stainless steel with four needle sharp barbs on 4" centers.

1. Coils: Minimum 24" diameter, multiple concertina type coil.

I. Concrete: ASTM C94, normal Portland cement, 2,500 psi at 28 days, 2" to 3" slump, 2 to 4 percent entrained air.

2.3 FABRICATION

A. Gates: Assemble gate frames by welding with both horizontal and vertical members and with diagonal cross-bracing of minimum 3/8" diameter adjustable length truss rods to ensure rigidity.

1. Swing Gates: Conform to ASTM F900; manufacturer's standard galvanized steel gates, 3'-0" wide unless otherwise indicated; complete with hardware including hasp for padlock.

a. Gate Frames: Minimum 1.9" outside diameter; 2.60 lbs/lin. ft.

b. Hinges: Non-lift-off type, offset to permit 180 degree opening, minimum 1-1/2 pair per gate leaf.

c. Locksets: Where gates are indicated to be locked provide mortise type locksets conforming to general requirements specified in Section 08 71 00 – Door Hardware.

1) Panic Devices (Where Indicated): Provide panic devices conforming to general requirements specified in Section 08 71 00.

2) Provide security casing for mortise locksets and panic devices and provide security screening for gates to prevent opening gates from secured side while allow egress from direction of travel for egress.

d. Accessories: Keepers, stops, and accessories as required for complete, secure fence gate installation.

2. Sliding Gates: Comply with ASTM F1184, Type II, Cantilever; manufacturer's standard top rail incorporating track for top roller and guideposts to keep gate on rollers.

3. Gate Operators: Heavy duty commercial quality gate operator sized as recommended by operator manufacturer for size of gate but not less than 1 H.P. motor with internal overload protection.

a. Operation: Wire operator to allow both remote control and key operation; gates to "auto close" after adjustable preset time.

1) Key Operation: Minimum 6 pin cylinder key boxes mounted on posts at locations indicated; posts to be included in Work of this section.

2) Remote Controls: Single channel digital radio transmitters with over 1000 Owner changeable codes, using 9-volt batteries

a) Provide 10 remote controls.

3) Safety Devices: Provide as required by applicable codes, including photo electric non-contact reversing control and electric gate edge to reverse gate operator.

b. Accessories: Provide as required for complete, automatically operated secure fence gate installation in configuration indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install line posts, corner posts, gates, rails, post caps, and fabric to provide rigid structure for fence of heights indicated and in accordance with CLFMI Installation Standard and ASTM F567.

1. Use manufacturer's standard fittings, fasteners and hardware.

B. Maximum Spacing of Posts: Comply with ASTM F567 and CLFMI Installation Standard.

C. Install line, corner, and terminal posts plumb in accordance with recommendations of ASTM F567 and CLFMI Standard for locations indicated on Drawings.

1. Coordinate embedded post sleeves with concrete work.

D. Position bottom rail continuous between posts and centered nominal 4” above finished grade or surface with bottom of fabric nominal 2” above finished grade or surface.

E. Position bottom of fabric 2" above finished grade or surface with tension wire stretched taut between posts.

F. Pass top rail through line post tops to form continuous bracing; install 7" long couplings mid-span at pipe ends.

G. Brace corner posts back to adjacent line post with horizontal center brace rail; install brace rail, one bay from end posts.

H. Fasten fabric to rails, line posts, braces and tension wires with wire ties maximum 12" centers.

I. Attach fabric to end, corner and gate posts with tension bars and tension bar clips.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is least dimension.

K. Install gates for free, easy operation, ready for Owner supplied padlock.

1. Install automatic gate operators in accordance with manufacturer recommendations and installation instructions for proper smooth operation; test gate operation and adjust as necessary for maximum lifespan of system.

END OF SECTION

SECTION 32 31 20

DECORATIVE METAL FENCE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Tubular steel ornamental fencing.
2. Tubular steel gates, frames and posts.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Gate Latch Products.

B. Shop Drawings: Provide complete dimensioned plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Templates: For anchors and bolts.

D. Samples: For each type and finish required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:

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

2. Steel Tubing: ASTM A 500, cold-formed steel tubing.

3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
4. Expanded Metal: ASTM 1267, Type I.
5. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.3 FASTENERS

A. General: Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners where exposed. Select fasteners for type, grade, and class required.

B. Cast-in-Place Anchors in Concrete: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2.4 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

C. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

D. Gate Latch and Hinges
1. Hardware: Provide latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
2. Hardware for gates occurring along a designated “Path of Travel” must comply with exit door requirements per 2007 CBC. Provide panic (push type) latch opening hardware on these gates (5lbs. maximum opening pressure) and provide solid stainless steel kick plates (12” high x gate width) 3” maximum from paving on both sides.

2.5 FABRICATION

A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.

3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

B. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts.

C. Steel Gate Frames: Fabricate from structural shapes and bars fully welded together. Reinforce frames and drill and tap as necessary to accept finish hardware. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

1. Exterior Frames: Galvanize.

D. Miscellaneous Steel Trim: Fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Exterior Miscellaneous Steel Trim: Galvanize

2.6 FINISHES

A. Steel and Iron Finishes:

1. Hot-dip galvanize items as indicated to comply with ASTM A 123/A 123M or ASTM A 153/A 153M as applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.

1. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.
2. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, pack solidly with nonshrink, nonmetallic grout.

C. Touch up surfaces and finishes after erection.
1. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 02826

SECTION 331000 –WATER UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Site water distribution system for domestic and fire protection service up to 5 feet of any on-site commercial building being served.

1.2 RELATED SECTIONS

A. Section 32 13 13 – Concrete Paving.

B. Section 31 23 33 – Excavation and Fill.

1.3 REFERENCES

A. ASTM:

1. B 88: Specifications for Seamless Copper Water Tube.
2. D 1785: Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. D 2564: Specifications for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

B. AWWA:

1. C512: Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
2. C550: Protective Epoxy Interior Coatings for Valves and Hydrants.
3. C605: Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.
4. C606: Grooved and Shouldered Joints.
5. C651: Disinfecting Water Mains.
6. C800: Underground Service Line Valves and Fittings.
7. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fittings, 4 In. Through 12 In. (100mm Through 300mm) for Water Distribution.
8. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm) for Water Transmission and Distribution.
9. C907: Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 In. through 8 In. (100 mm Through 200 mm).
10. C908: PVC Self-Tapping Saddle Tees for Use on PVC Pipe.
11. M23: PVC Pipe – Design and Installation.

1.4 QUALITY ASSURANCE

A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.

B. Comply with the following requirements and standards:

1. NSF 61: “Drinking Water System Components-Health Effects” for materials for potable water.
2. NFPA 24: “Installation of Private Fire Service Mains and Their Appurtenances” for materials, installations, tests, flushing, and valve and hydrant supervision.
3. CEC 70: “California Electric Code” for electrical connections between wiring and electrically operated devices.

C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

1.5 SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: Provide data on product characteristics, performance criteria and limitations.

C. Shop drawings: Include plans, elevations, details and attachments.
1. Precast and cast in-place vaults and covers.
2. Wiring diagrams for alarm devices.

D. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

1.6 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. ASTM: American Society for Testing Materials.

C. AWWA: American Waterworks Association

D. DI: Ductile iron.

E. DIP: Ductile iron pipe.

F. FM: Factory Mutual.

G. NFPA: National Fire Protection Association.

H. NSF: National Sanitation Foundation.

I. PCC: Portland cement concrete.

J. PE: Polyethylene.

K. PVC: Polyvinyl Chloride.

L. UL: Underwriters Laboratory.

M. CEC: California Electrical Code

1.7 MATERIAL DELIVERY, STORAGE AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set Valves in best position for handling. Set valves closed to prevent rattling.

B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture

C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. During Storage: Use precautions for valves, including fire hydrants according to the following.
1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

E. Do not store plastic pipe and fittings in direct sunlight.

F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.

G. Protect linings and coatings from damage.

H. Handle precast boxes, vaults and other precast structures according to manufacturer's written instructions.

I. Protect imported bedding and backfill material from contamination by other materials.

1.8 COORDINATION

A. Coordinate connection to existing water mains with water utility supplying water.

B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping

PART 2 PRODUCTS

2.1 SMALL SIZE SERVICE PIPES

A. PVC Pipe: Sizes ¾ -inch through 3 inch.
1. Pipe and Fittings: ASTM D 1785, Schedule 40 PVC
2. Joints: Restrain with solvent cement. Do not use threaded pipe.
3. Solvent Cement: ASTM D2564.

2.2 LARGE SIZE SERVICE AND DISTRIBUTION PIPES

A. PVC Pipe: Sizes 4-inch through 48-inch.
1. Pipe:
a. 4-inch through 12-inch: AWWA C900.

b. 14-inch through 48-inch: AWWA C905.

2. Fittings: DI conforming to 2.2A above.
3. Unrestrained Joints:
   a. Push-On Bell and Spigot Joint: AWWA C900.
4. Restrained Joints:
   a. Push-On Bell and Spigot Joint: Harness assembly as manufactured by Ebaa Iron (Eastland, Tx) (Tel. 800-433-1716) or approved equal.
   b. Plain End PVC to DI Mechanical Joint: Ebaa Iron (Eastland, Tx) (Tel. 800-433- 1716) or approved equal.
5. PVC Couplings
   a. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by CertainTeed (Valley Forge, PA) (Tel. 610 341-6820) or approved equal.
   b. Restrained Plain End to Plain End Pipe: AWWA C900, “Certa-Lock” as manufactured by CertainTeed (Valley Forge, PA) (Tel. 610 341-6820) or approved equal.

2.3 SERVICE LINE VALVES AND FITTINGS

A. General: AWWA C-800

B. Includes service lines, 1/2 inch through 2 inch, from main to meter valve, including corporation stops and curb stops.

2.4 GATE VALVES

A. Provide on lines 10-inch and smaller.

B. Valves, 3-Inch through 20-Inch: AWWA C509, resilient-seated, non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise. All bolts, nuts and washers, except operating nut, shall be stainless steel. Stem operating nut to be 2-inches square and open counter-clockwise. Stem extensions shall be installed to bring the stem operating nut to within 2-feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4-feet. Equip valves in pump stations and other interior or vault installations with hand-wheels. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer’s recommendations.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Mueller Company (Decatur, IL) (Tel.800-423-1323).
   2. M&H Valve Company (Anniston, AL) (Tel. 205-237-3521).
   3. Crane Company (New York, NY).

D. Valve Box and Cover: 9-inch minimum diameter PCC box with extensions of length required for depth of bury of valve, and cast iron or ductile iron cover with lettering “WATER”. Both the box and the cover shall be rated for AASHTO H20 loading.

2.5 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES

A. AWWA C512, specific type of valve, size, details and valve box as indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:

1. Apco Valves, Valve and Primer Corporation (Schaumburg, IL) (Tel. 708-529-9000).
2. Crispin.

2.6 BLOW-OFF VALVES

A. Blow-off valve assemblies, details and boxes as indicated.

2.7 FIRE DEPARTMENT CONNECTION

A. Exposed, Freestanding Fire Department Connection: UL 405, cast brass body with threaded inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets and chains; lugged swivel connections and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate. Two 2-1/2-inch NPS inlets and 4-inch NPS outlet.

2.8 TRACER WIRE

A. General: Minimum #12 AWG stranded copper wire with blue THW, THWN, or THHN rated insulation.

2.9 WARNING TAPE

A. General: Non-detectable 3-inch warning tape made of solid blue film with continuously printed black-letter message reading “CAUTION—WATER LINE BURIED BELOW.”

2.10 PCC THRUST BLOCKS

A. Concrete for Thrust Blocks and Valve Box Surface Collars: Concrete type specified in Section 32 13 13

PART 3 EXECUTION

3.1 PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer’s instructions, and in accordance with the following:

1. PVC pipe: AWWA M23 and AWWA C605.

B. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Sections 31 23 00 and 31 23 33.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer’s recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Lay pipe on a bed of bedding material specified and prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout it’s entire length with bell holes

provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.2 CONNECTING TO EXISTING MAINS

A. Pressure Tap Connections: Perform in accordance with the requirements of the owner of the system being tapped. Maintain a positive pressure flow from the main being tapped to the tapping device to flush plastic chips, metal ribbons, etc. into the tapping devise and not into the pipe being tapped.

B. Other Connections: As indicated and in accordance with the requirements of the owner of the line being connected to.

3.3 ANCHORAGE INSTALLATION

A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.

B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24-hours curing time before introducing water into the pipeline and allow a minimum of 7-days curing time before pressure testing.

3.4 VALVE INSTALLATION

A. Install all valves in accordance with the manufacturer's instructions and the following:
   1. General:
      a. Gate Valves: Appendix A of AWWA C509.
   2. Joints:
      a. Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.

3.5 SERVICE CONNECTIONS INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system.

3.6 POST INDICATOR VALVE INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

3.7 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system and the fire department.

3.8 TRACER WIRE INSTALLATION

A. Place and secure to top of pipe and fittings at about 3-foot intervals with 6” length of 1” wide filament tape, Scotch brand No. 898 or equal.

B. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance designated by the owner of the system or the Owner’s Representative. Extend the wire up the outside of the valve box/riser and cut a hole that is 8-inches from the top, extend a 12-inch wire lead to the inside of the box. At other pipeline appurtenances, designated by the owner of the system or the Owner’s Representative, terminate the 12-inch wire lead inside the enclosure.

C. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician’s tape.

3.9 WARNING TAPE INSTALLATION

A. Install tape approximately 1-foot above and along the centerline of the pipe.

B. Where tape is not continuous, lap tape ends a minimum of 2-feet.

3.10 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. General:

1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Test pressure: See Subsection titled “System Performance Requirements.”
7. Apply test pressure by means of a pump connected to the pipe.
8. Base test pressure on the elevation of the lowest point in the line.
9. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
10. Allow the system to stabilize at the test pressure before conducting the leakage test.
11. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
12. Maintain test pressure as specified for type of pipe being tested.
13. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
14. Leakage Test: Perform as specified hereafter for the type of pipe being installed.

B. PVC Pipe Leakage Test: Perform in accordance with AWWA M23.Selected requirements of AWWA M23 are repeated as follows:

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.

2. No piping will be accepted if the leakage is greater than that determined by the following formula:

L = (N X D X P1/2)/7,400
L = ALLOWABLE LEAKAGE, GALLONS PER HOUR.
N = NUMBER OF JOINTS IN THE LENGTH OF THE PIPELINE TESTED. D = NOMINAL DIAMETER OF PIPE, INCHES.
P = AVERAGE TEST PRESSURE DURING THE LEAKAGE TEST, POUNDS PER SQUARE INCH (GAUGE).

3.11 DISINFECTION

A. All New Pipelines shall be disinfected in accordance with one of the three methods specified in AWWA C651 and the following:

1. Disinfect after pressure and leakage test have been performed and accepted.

2. The method used shall be at the Contractor's option, unless specified by the owner of the water system.

3. Engage the services of a commercial testing laboratory, approved by the owner of the water system, to perform the bacteriological tests specified in Section 5.1 of AWWA C651. Direct the testing laboratory to send the original report of the bacteriological testing to the owner of the water system. Should the laboratory report show that any sample taken was not acceptable, repeat the sterilization process shall until a satisfactory sterilization is accomplished.

4. Lawfully dispose of the chlorinated water

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 333000 – SANITARY SEWER UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roadway and/or site sanitary gravity sewers and force mains up to 5 feet of any on- site building.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Utility Trenching and Backfill.

B. Section 32 13 13 – Concrete Paving.

1.3 RELATED DOCUMENTS

A. AASHTO:

1. M 199: Precast Reinforced Concrete Manhole Sections.
2. M 252: Corrugated Polyethylene Drainage Tubing.
3. M 294: Corrugated Polyethylene Pipe, 12 to 24-inch Diameter.

B. ASTM:

1. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
2. A 674 Practice for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids.
3. 443: Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
4. C 478: Precast Reinforced Concrete Manhole Sections.
5. C 1173: Flexible Transition Couplings for Underground Piping Systems.
6. C 1244: Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test.
7. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
8. D 2235: Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
9. D 2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
10. D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
11. D 2751: Acrylontrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
12. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
13. D 4101: Propylene Injection and Extrusion Materials.
14. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
15. F 656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
16. F 679: Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and

Fittings.

17. F-1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.

C. AWWA:

1. C104: Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. C150: Thickness design of Ductile Iron Pipe.
6. C151: Ductile-Iron Pipe, Centrifugally Cast, for Water.
7. C153: Ductile-Iron Compact Fittings for Water Service.
8. M41: Ductile Iron Pipe and Fittings.

D. Caltrans Caltrans Standard Specifications.

1. Section 51, Concrete Structures.
2. Section 65, Reinforced Concrete Pipe
3. Section 75 Miscellaneous Metal.

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials.

B. ABS: Acylonitrile-butadiene-styrene.

C. ASTM: American Society for Testing Materials.

D. AWWA: American Water Works Association.

E. HDPE: High-density polyethylene.

F. PE: Polyethylene.

G. DIP: Ductile iron pipe.

H. PVC: Polyvinyl Chloride.

I. RCP: Reinforced concrete pipe.

J. NPS: Nominal pipe size.

1.5 SUBMITTALS

A. Follow submittal procedure outlined in Section 01 33 00.

B. Product data for the following:

1. Piping materials and fittings.
2. Special pipe couplings.
3. Joint sealants.

4. Cleanout plugs or caps.
5. Sewage air relief valves.

C. Shop drawings: Include plans, elevations, details and attachments for the following:
1. Precast concrete manholes, frames and covers.
2. Precast concrete clean out boxes and box covers.
3. Force main piping access openings.

D. Design Mix Reports and Calculations: For each class of cast in place concrete.

E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, fittings, and seals from dirt and damage.

C. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.

D. Protect imported bedding and backfill material from contamination by other materials

PART 2 PRODUCTS

2.1 PIPING MATERIALS FOR GRAVITY FLOW

A. PVC Pipe:
1. Pipe:
a. 4-inch through 15-inch: ASTM D 3034, SDR 26. Bell and spigot joints.
b. 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.
2. Fittings:
a. 4-inch through 27-inch: ASTM F 1336.
b. 30-inch through 36-inch: ASTM D 3034, SDR 26
3. Joint Gasket: Elastomeric seal, ASTM F 477.

2.2 SPECIAL PIPE COUPLINGS

A. Gravity Piping: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.3 GRAVITY PIPE CLEANOUTS

A. Piping: Same as sanitary sewer line if possible.

B. Top Cap: Threaded and of same material as piping if possible.

C. Box Size: As required to provide access and allow easy removal and reinstallation of cap.

D. Box Types:

1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty.
2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading.

E. Box Cover Markings: “sewer” unless otherwise specified.

F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:

1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486 7070).

2.4 MANHOLES

A. General: Size, shape, configuration, depth, etc. of manhole and frame and cover shall be as indicated.

B. Portland Cement Concrete and Reinforcing:

1. Poured-in-Place Portion: Section 03 30 00.
2. Precast Portion: ASTM C 478. Rate for AASHTO H20 loading in traffic areas.

C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-1.02.

D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408- 262-1091) or equal.

E. Force Main Piping Access Openings:

F. General: As indicated.

2.5 JOINT SEALANT FOR STRUCTURES AND MANHOLES

A. Mortar: Caltrans Standard Specification Section 51-1.135.

1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket.

1. Rubber Gaskets: ASTM C443.
2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by the K. T. Snyder Company (Houston TX), or equal.

2.6 SEWAGE AIR RELIEF VALVE ASSEMBLY FOR FORCE MAINS

A. General: As indicated.

2.7 THRUST BLOCKS FOR FORCE MAINS

A. General: Location, configuration bearing area, etc. as indicated.

B. Portland Cement Concrete: Section 03 33 00

PART 3 EXECUTION

3.1 GRAVITY PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-1.07 for reinforced concrete pipe and chapter 11.3.3 of AWWA M41 for ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout it's entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance at the end of each days work or when work is not in progress.

3.2 SPECIAL PIPE COUPLINGS

A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

B. Installation: Manufacturer's instructions.

3.3 CLEANOUT INSTALLATION

A. General: Install as indicated.

3.4 MANHOLE INSTALLATION

A. General: Install as indicated.

3.5 AIR RELIEF VALVE ASSEMBLY INSTALLATION

A. General: Install as indicated.

3.6 TESTING OF GRAVITY PIPING MAINS

A. Obstructions: After backfilling and compacting, but before paving or other surface improvements, test sewer for obstructions either by rodding or by the sewer ball method. Provide for intercepting all grit, rocks and other flushed debris to keep debris from entering the existing system.

B. At the option of the Contractor, either the following hydrostatic or air test shall be performed.

C. Hydrostatic Test

1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
2. Test sewer mains between successive manholes by closing the lower end of the sewer main to be tested and the inlet sewer main of the upper manhole with stoppers.
3. Fill pipe and manholes with water to a point four feet below the ground surface of the upper manhole, but in no case less than four feet above the pipe invert. If ground water is present, the water surface at the upper manhole shall be at least four feet above the level of the ground water.
4. Fill piping at least one hour prior to testing.
5. Test piping at least two hours by maintaining the head specified above with measured additions of water. The sum of these additions of water, in the two-hour test period, shall be the leakage amount.
6. The maximum allowable head of water above any porti9n of sewer being tested shall be 15-feet. Where the difference in elevation between successive manholes exceeds 15-feet, a test tee shall be installed between manholes, and the testing shall be carried on between the tee and the manhole.
7. The allowable leakage shall not exceed 0.1-gallons per minute per inch diameter, per 1000-feet of sewer main being tested.
8. If the leakage exceeds the above amount, determine the cause and remedy it prior to retesting.
9. If the leakage is less than the allowable, but leaks are observed, repair the observed leaks.

D. Air Test:

1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
2. Apply to each length between adjacent manholes.
3. Supply pressure gauge with minimum divisions of 0.10-psi and with an accuracy of +/- 0.04-psi. When requested by the Owner’s Representative, provide certification that the gauge has been tested for accuracy within the last six months by a reliable testing firm.
4. Pressurize the test section to 3.5-psi, and then hold the pressure above 3.0-psi during a saturation period of at least 5 minutes. At the end of the saturation period, note the pressure, which must be a minimum of 3.0-psi, and begin the

timed period. If the pressure drops 0.5-psi in less than the time given in the following table the section of pipe has not passed the test.

PIPE SIZE	MINIMUM TIME ALLOWED FOR PRESSURE TO DROP 0.5-PSI
4”	125 SECONDS
6”	185 SECONDS
8”	245 SECONDS
10”	310 SECONDS
12”	370 SECONDS
15”	460 SECONDS
18”	555 SECONDS
21”	10 MINUTES
24”	12 MINUTES
27”	14 MINUTES
30”	16 MINUTES
36”	18 MINUTES
42”	20 MINUTES
48”	23 MINUTES
54”	26 MINUTES

5. If the time for the pressure to drop 0.5-psi is 125% or less of the time indicated, the line shall immediately be re-pressurized to 3.0-psi and the test repeated. If, during the 5-minute saturation period, the pressure drops less than 0.5-psi after the initial pressurization and air is not added, the section undergoing the test shall have passed.
6. If the test did not pass, find and repair the leak to the satisfaction of the Owner’s Representative.
7. When the prevailing ground water is above the line being tested the air pressure shall be increased 0.43-psi for each foot the water table is above the invert of the pipe at the highest manhole.

3.7 TESTING OF LATERALS

A. At the option of the Contractor, either the following hydrostatic or air test shall be performed.

B. Hydrostatic Test:

1. Test laterals before backfilling.
2. Plug lateral at its ends and fill with water through the cleanouts.
3. Maintain the water level in the cleanouts as high as possible throughout the test period.
4. One hour after filling with water, examine the lateral for leakage.
5. Repair all leaks to the satisfaction of the Owner’s Representative.
6. Do not backfill the trench until testing and repairs of the lateral are complete, and approved by the Owner’s Representative.
7. Following approval of the Owner’s Representative, remove all plugs, dispose of the water and complete the connection to the main.

C. Air Test

1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
2. Test in accordance with subsection above titled “Testing of Gravity Piping Mains,” paragraph titled “Air Test.”

3.8 TESTING OF MANHOLES ON GRAVITY LINES.

A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.

B. Hydrostatic Test:

1. Insert inflatable plugs in all sewer inlets and outlets.
2. Fill the manhole with water to a point six inches below the base of the manhole frame.
3. Maintain the water at this point for one hour to allow time for absorption.
4. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
5. Determine the allowable leakage by the following formula. L = 0.0002 x D x H1/2

L = ALLOWABLE LEAKAGE, GALLONS PER MINUTE.
D = DEPTH OF MANHOLE FROM TOP TO BOTTOM, FEET.
H = HEAD OF WATER IN FEET AS MEASURED FROM THE SURFACE OF THE WATER IN THE MANHOLE TO THE SEWER LINE INVERT OR TO THE PREVAILING GROUND WATER SURFACE OUTSIDE THE MANHOLE. THE LESSER HEIGHT GOVERNS.

6. If the leakage exceeds the allowable, determine the cause, take remedial action and re-test the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.

C. Vacuum Test:

1. General: Test in accordance with ASTM C 1244.
2. Test prior to backfilling around the manhole.
3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
4. Place test head inside the top section of the manhole’s cone section and inflate in accordance with the manufacturers instructions.
5. Draw a vacuum of 10-inches of mercury and shut the pump off.
6. With the valve closed, the time for the vacuum to drop 9-inches shall be measured.
7. The manhole shall pass the test if the time is greater than 60 seconds for a 48-inch diameter manhole, 75 seconds for a 60-inch diameter manhole and 90 seconds for a 72-inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout while the vacuum is still being drawn. Retest until a satisfactory test is obtained.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 334000 – STORM DRAIN UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roadway and/or site storm drainage up to 5-feet of any on-site building.

1.2 RELATED SECTIONS

A. Section 31 23 33 – Trenching and Backfill.

B. Section 32 13 13 – Concrete Paving.

1.3 Related Documents

A. AASHTO:
1. M 199: Precast Reinforced Concrete Manhole Sections.
2. M 252: Corrugated Polyethylene Drainage Pipe.
3. M 294: Corrugated Polyethylene Pipe, 12 to 48-inch Diameter.

B. ASTM:
1. A 74: Cast Iron Soil Pipe and Fittings.
2. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
3. A 716: Ductile Iron Culvert Pipe
4. A 746: Ductile Iron Gravity Sewer Pipe
5. C 443: Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
6. C 478: Precast Reinforced Concrete Manhole Sections.
7. C 564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
8. C 1103: Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
9. C 1173: Flexible Transition Couplings for Underground Piping Systems.
10. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. D 2235: Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and fittings.
12. D 2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
13. D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
14. D 2751: Acrylontrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
15. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
16. D 4101: Specifications for Propylene Injection and Extrusion Materials.
17. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
18. F 656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC)Plastic Pipe and Fittings.
19. F 679: Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
20. F-1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.

C. AWWA:
1. C104: Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.

3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. C150: Thickness design of Ductile Iron Pipe.
6. C151: Ductile-Iron Pipe, Centrifugally Cast, for Water.
7. C153: Ductile-Iron Compact Fittings for Water Service.
8. M41: Ductile Iron Pipe and Fittings.

D. Caltrans Standard Specifications:
1. Section 51, Concrete Structures.
2. Section 52, Reinforcement.
3. Section 65, Reinforced Concrete Pipe.
4. Section 66, Corrugated Metal Pipe.
5. Section 70. Miscellaneous Facilities.
6. Section 72, Slope Protection.
7. Section 75 Miscellaneous Metal.

E. Caltrans Standard Plans:
1. Plan D94A: Metal and Plastic Flared End Sections.
2. Plan D94B: Concrete Flared End Sections.
3. Plan D97A: Corrugated Metal Pipe Coupling Details No.1, Annular Coupling Band Bar and Stra p and Angle Connection.
4. Plan D97B: Corrugated Metal Pipe Coupling Details No. 2, Hat Band Coupler and Flange Details.
5. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers.
6. Plan D97D:Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands.
7. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint.
8. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint.
9. Plan D97G: Corrugated Metal Pipe Coupling Details No. 7, Positive Joints and Downdrains.
10. Plan D98A: Slotted Corrugated Steel Pipe Drain Details.
11. Plan D98B: Slotted Corrugated Steel Pipe Drain Details.

F. Definitions
1. AASHTO: American Association of State Highway and Transportation Officials
2. ABS: Acylonitrile-butadiene-styrene.
3. ASTM: American Society for Testing Materials.
4. AWWA: American Water Works Association.
5. CMP: Corrugated metal pipe.
6. DIP: Ductile iron pipe.
7. HDPE: High-density polyethylene.
8. NPS: Nominal pipe size.
9. PE: Polyethylene.
10. PVC: Polyvinyl chloride.
11. RCP: Reinforced concrete pipe.

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data Shop Drawings, Etc.: For the following:
1. Piping materials and fittings.
2. Special pipe couplings.

3. Polymer-concrete, channel drainage systems (trench drains).
4. Joint sealants.
5. Plastic area drains.
6. Cleanout plugs or caps.
7. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates.
8. Precast clean out boxes and box covers.
9. Concrete, metal and plastic flared end sections.

C. Design Mix Reports and Calculations: For each class of cast in place concrete.

D. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic structures, pipe and fittings in direct sunlight.

B. Protect pipe, fittings, and seals from dirt and damage.

C. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.

D. Protect imported bedding and backfill material from contamination by other materials

PART 2 PRODUCTS

2.1 PIPING MATERIALS

A. ABS Pipe and Fittings: Smaller than 4-inch, ASTM D 2751, SDR 35. Solvent cement joints.
1. Solvent Cement: ASTM D 2235.

B. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 35. Bell and spigot joints.
1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.

C. Cast Iron Pipe and Fittings: Hub and spigot, 2-inch through 15-inch, ASTM A74, service class.
1. Gaskets: ASTM C 564, rubber, compression type, thickness to match class of pipe.

D. Corrugated Metal Pipe and Fittings: Caltrans Standard Specification Section 66.
1. Bituminous Coating: Caltrans Standard Specification Section 66-1.03.
2. Bituminous Lining: Caltrans Standard Specification Section 66-1.03.
3. Bituminous Pavings: Caltrans Standard Specification Section 66-1.03.
4. Corrugated Aluminum Pipe: Caltrans Standard Specification Section 66-2.
5. Corrugated Steel Pipe: Caltrans Standard Specification Section 66-3.
6. Slotted Corrugated Steel Pipe: Caltrans Standard Specification Section 66-3.09.
7. Details: Caltrans Standard Plans D97A, D97B, D97C, D97D, D97E, D97F, D97G, D98A and D98B.

E. DIP: Sizes 4-inch through 48-inch.
1. Pipe: AWWA C150 and C151 or ASTM A 716 or A 746.
2. Pressure Class: Minimum pressure class for size indicated.
3. Fittings:

a. Standard: AWWA C110, sizes 4-inch through 48-inch.
b. Compact: AWWA C153, sizes 4-inch through 24-inch.

4. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
5. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
6. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
7. Joints:
   a. Push-On Bell and Spigot Joint: AWWA C111.
   b. Mechanical Joint: AWWA C111.
   c. Flanged joint. AWWA C115.

F. Reinforced Concrete Pipe: Designated by Class, rubber gasketed joints.
1. Circular Reinforced Concrete Pipe: Caltrans Standard Specification Section 65- 1.02A(1). Class III.
2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-1.02B. Class HE-III and VE-III.
3. Reinforced Concrete Pipe Arch: Caltrans Standard Specification Section 65-1.02C.
4. Rubber Gasketed Joints: Caltrans Standard Specification Section 65-1.06.

G. PE Pipe and Fittings: 15-inch through 36-inch, AASHTO M 252, Type S, smooth interior and corrugated exterior. Bell and spigot joints.
1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.

H. PE Pipe and Fittings: 12-inch through 48-inch, AASHTO M 294.Type S, smooth interior and corrugated exterior. Bell and spigot joints.
1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
2. Couplings: AASHTO M 294, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.

I. PVC Pipe and Fittings-Smaller than 4-Inch: ASTM D1785, Schedule 40.
1. Joints: Solvent Cement, ASTM D 2564. Include primer according to ASTM F656.

J. HDPE Dual Wall, 15-inch and larger

K. PVC Pipe and Fittings,4-Inch to 12-Inch
1. Pipe:
   a. 4-inch through 12-inch: ASTM D 3034, SDR 35. Bell and spigot joints.
   b. 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.
2. Fittings:
   a. 4-inch through 27-inch: ASTM F 1336.
   b. 30-inch through 36-inch: ASTM D 3034, SDR 35
3. Joint Gasket: Elastomeric seal, ASTM F 477.

2.2 SPECIAL PIPE COUPLINGS

A. Plastic, Cast Iron and Ductile Iron Pipe: ASTM C 1173. Rubber or elastomeric sleeve and stainless steel band assembly fabricated to match outside diameters of pipes to be joined.

B. Reinforced Concrete Pipe: Portland cement collar as indicated.

2.3 CLEANOUTS

A. Piping: Same as storm drain line if possible.

B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.

C. Box Size: As required to provide access and allow easy removal and reinstallation of plug or cap.

D. Box Types:
1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty.
2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading.

E. Box Cover Markings: “Storm Drain” unless otherwise specified.

F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486-7070).

2.4 CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.

B. Concrete Paving: Section 321313.

C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.

D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408- 262-1091).

E. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75- 1.03 and 75-1.05.
1. Galvanize steel frames, grates and covers.
2. Grates and covers shall be non-rocking.
3. Rate for AASHTO H20 loading in traffic areas.

2.5 MANHOLES

A. General: Size, shape, configuration, depth, etc. of manhole and frame and cover shall be as indicated.

B. Portland Cement Concrete and Reinforcing:
1. Poured-in-Place Portion: Section 321313.
2. Precast Portion: ASTM C 478 or AASHTO M199. Rate for AASHTO H20 loading in traffic areas.

C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-1.02, marked “S.D.” unless otherwise specified.

D. Steps: Manufacture from deformed, ½-inch steel reinforcement rod complying with A 615/A 615M and encased in polypropylene complying with ASTM D 4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091) or equal.

2.6 JOINT SEALANT FOR PRECAST STRUCTURES AND MANHOLES

A. Mortar: Caltrans Standard Specification Section 51-1.135.
1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket.
1. Rubber Gaskets: ASTM C 443.
2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek” as manufactured by the K. T. Snyder Company (Houston TX) or equal.

2.7 POLYMER-CONCRETE TRENCH DRAINS

A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.

B. Include the following components:
1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.

C. Locking Mechanism: Manufacturer’s standard device for securing grates to channel sections.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. “Polydrain” by ABT Inc. (Troutman, NC) (Tel 704-528-9806).
2. “ACO Drain” by ACO Polymer Products Inc. (Chardon, OH) (Tel. 800-543-4764).

2.8 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS

A. General: Caltrans Standard Specification Section 70-1.02C and Caltrans Standard Plan D94A and D94B

PART 3 EXECUTION

3.1 PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-1.07 for reinforced concrete pipe, Caltrans Standard Specification Sections 66-1.045 and 66-105 for corrugated metal pipe and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 00.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout it's entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

3.2 INSTALLATION OF PIPE ANCHORS

A. Install at location, configuration and details shown on the Plans.

3.3 SPECIAL PIPE COUPLINGS

A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

B. Installation: Manufacturer instructions.

3.4 CLEANOUT INSTALLATION

A. General: Install as indicated.

3.5 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC. AND MANHOLES

A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 00.

B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
1. Shape bottoms to convey flows as indicated.

C. Precast Structures: Install as indicated.
1. Seal all joints and pipe entrances and exits.
2. Place concrete in bottom and shape to convey flows as indicated.

3.6 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION
1. Excavation, Bedding, Backfill, and Compaction: Section 31 23 00.
2. Install: As indicated and in accordance with the manufacturer's instructions.

3.7 CONCRETE OR PLASTIC FLARED END SECTION INSTALLATION

A. Install: As indicated.

3.8 SLOPE PROTECTION PLACEMENT

A. Rock Slope Protection: Caltrans Standard Specification Section72-2.03 and as indicated.
1. Use Method B Placement unless otherwise indicated.

B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.02 and 72-4.04.

C. Concreted-Rock Slope Protection: Caltrans Standard Specification Section 72-5.03 and 72-5.04.
1. Use Method B Placement unless otherwise indicated.

D. Sacked Concrete Slope Protection.
1. Detailed configuration: As indicated.
2. Use one cubic foot of concrete per sack.
3. Locate headers and stretchers as indicated.
4. Headers: Folded end to bank.
5. Stretchers: Folded ends are not to be adjacent.
6. Place no more than four vertical courses until initial set has taken place in first course.

3.9 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT

A. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.02 and 72-4.04.

3.10 TESTING

A. General: Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
4. Submit separate reports for each test.
5. Where authorities having jurisdiction do not have published procedures, perform tests in accordance with latest edition of the California Plumbing Code (CPC) Section 1109.0, Testing.
6. Leaks and loss in test pressure constitute defects that must be repaired.
7. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

B. Reinforced Concrete Pipe:
1. Reinforced concrete pipe, sizes 27-inch and larger, shall be hydrostatically joint tested, (air test is not to be used), in the field for water-tightness in accordance with ASTM Standard C 1103.
2. Perform test after pipe is bedded but prior to any backfill.
3. Testing may be done by manufacturing pipe with double gasket joints, or by utilizing a joint tester. Contractor shall obtain the Owner's Representative's approval of details of the Contractor's selected method prior to performing the testing.
4. Inspect all joints for leakage.
5. If the pressure holds, or drops less than 1psi in 5 seconds, the joint is acceptable.

END OF SECTION 334000