



Project Manual

Madera High School Stadium

200 South L Street, Madera, CA 93637

Bidding and Contract Requirements
and
Specifications

for the

Madera Unified School District

1902 Howard Road, Madera, CA 93637

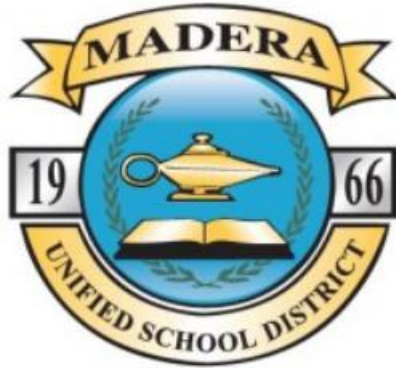
Date: July 17, 2025

PBK Project No.: 20-51

DSA File No.: 20-H3

DSA App. No.: 02-122784

PROCUREMENT AND CONTRACTING DOCUMENTS
SPECIFICATIONS



Madera High School Stadium
200 S. L Street,
Madera, California 93637

MADERA UNIFIED SCHOOL DISTRICT
1905 Howard Road,
Madera, California 93637

Michael Schoen, Architect

Brian Barcus, Structural Engineer

Richard Hardin, Electrical Engineer

Ryan Carlson, Mechanical Engineer

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

APP: 02-122784 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 7/17/2025



Architect's Project No: 20-51
File No: 20-H3
App. No: 02-121624

PBK

7790 NORTH PALM AVENUE FRESNO, CALIFORNIA 93711 (559) 448-8400

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**SECTION 01 10 00
SUMMARY**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Phased construction.
 - 4. Work under separate contracts.
 - 5. Access to site.
 - 6. Coordination with occupants.
 - 7. Work restrictions.
 - 8. Specification and drawing conventions.
 - 9. Miscellaneous provisions.
- B. Related Requirements:
 - 1. Section 01 50 00 - Temporary Facilities and Controls for limitations and procedures governing temporary use of Owner's facilities.

1.02 PROJECT INFORMATION

- A. Project Identification: Madera High School Football Stadium Fieldhouse.
 - 1. Project Location: Madera, California.
- B. Owner: Madera Unified School District.
 - 1. Owner's Representative: Rosalind Cox
- C. Architect: Michael Schoen, PBK
 - 1. Project Manager: Sergio Martinez
- D. Project Web Site: A project Web site administered by Architect will be used for purposes of managing communication and documents during the construction stage.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Construction of lockers, classrooms, concessions buildings, ticket booths, press box, bleachers, and alteration of track surfacing.
- B. Type of Contract.
 - 1. Project will be constructed under one General Contractor deemed lowest responsible bidder.
 - 2. The project will be awarded to the lowest responsive bidder.

1.04 ACCESS TO SITE

- A. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to as directed by District.

2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.05 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.06 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. All substitutions that affect Structural Safety, Fire and Life Safety, or Access Compliance shall be submitted to the Division of the State Architect for review and approval.
- C. Related Requirements:
 - 1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.02 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions should only occur prior to the bid. During construction only if there is a benefit to the owner or a hardship to the project has occurred. NO SUBSTITUTIONS DURING SUBMITTALS.

1.03 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and

- specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from CBC 2022.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.04 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution will not adversely affect Contractor's construction schedule.
 - c. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - d. Requested substitution is compatible with other portions of the Work.
 - e. Requested substitution has been coordinated with other portions of the Work.
 - f. Requested substitution provides specified warranty.
 - g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.

- g. Requested substitution has been coordinated with other portions of the Work.
- h. Requested substitution provides specified warranty.
- i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION

**SECTION 01 29 00
PAYMENT PROCEDURES**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

- A. Pencil Copy: A copy submitted prior to a final/official.
- B. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination:
 - 1. Coordinate preparation of the schedule of values with preparation of Contractor's Construction Schedule:
 - a. Coordinate line items in the schedule of values with administrative forms and schedules, including the following:
 - 1) Application for Payment forms with continuation sheets.
 - 2) Updated submittal schedule.
 - 3) Items required to be indicated as separate activities in updated Contractor's Construction Schedule.
 - b. Submit the schedule of values to Architect at earliest possible date, but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment. Contractor's standard form or electronic media printout will be considered but must be approved by Owner.
- B. Format and Content:
 - 1. Use Project manual table of contents as a guide to establish line items for the schedule of values. Provide at least one (1) line item for each Specification Section:
 - a. Identification:
 - 1) Include the following Project identification on the 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. Arrange schedule of values consistent with format of AIA Documents G702/G703.
 - 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.

- c. Name of Subcontractor.
- d. Name of manufacturer or fabricator.
- e. Name of supplier.
- f. Change Orders (numbers) that affect value.
- g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent (.01%), adjusted to total 100 percent:
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment rentals.
 - 4) General Conditions:
 - a) Supervisor.
 - b) Submittals.
 - c) Closeout.
 - d) Field Engineering.
 - e) Daily Clean-up.
 - f) Final Clean-up.
- 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 5. Provide separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed:
 - a. Differentiate between items stored on site and items stored off site. Include evidence of insurance.
- 6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line item value of unit cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- 7. Each item in the schedule of values and Applications 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 the schedule of values or distributed as general overhead expense.
- 8. Schedule updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATION FOR PAYMENT

- A. Submit preliminary (pencil) copy of proposed values to PBK Construction Field Representative and Owner for review by the 20th of the month. Allow four (4) days for comments. Schedule review of the pencil copy during bi-monthly site visits.
- B. Once preliminary (pencil) approved, submit four (4) notarized originals of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702 or other similar form approved by Owner.
- C. Content and Format: Utilize schedule of values for listing items in Application for Payment.
- D. Submit updated construction or recovery schedule with each Application for Payment.
- E. Payment Period: Submit at intervals stipulated in Owner/Contractor Agreement. Include Supplementary Conditions of the Contract.
- F. Only materials stored on the Project site shall be paid for unless the materials are stored in a bonded warehouse agreed upon by Owner. Periodic review of stored item will be required by the inspector of record.

- G. Substantiating Data:
1. When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Items that may be requested by Architect or Owner to substantiate costs include, but are not limited to the following:
 - a. Current Record Documents as specified in Section 01 77 00: Closeout Procedures.
 - b. Labor time sheets, purchase orders, or similar documentation.
 - c. Affidavits attesting to products stored off-site.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 29 00

**SECTION 01 29 73
SCHEDULE OF VALUES**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Schedule of values listing to be edited by Contractor of description of Work, not scheduled value, Work completed, stored materials, total complete, percentage, balance to finish, and retainage. These parts must remain intact.
- B. Related Sections:
 - 1. Section 01 29 00: Payment Procedures.

1.3 DEFINITIONS

- A. Pencil Copy: A copy submitted prior to a final/official submission on a monthly basis.
- B. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

MATRIX TO START ON NEXT PAGE:

This is a sample illustration:

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Div. 1 - General Reqs. Site Work General Conditions Supervision Mobilization Bonds & Insurance Permits Contractor's Fee Closeout Documents								
	Div. 1 - Total								
	Div. 2 - Existing Conditions Demolition (As applicable) Erosion Control Div. 2 - Total								
	Div. 3 - Concrete Drill Piers Caps & Beams Slab on Grade Cooling Tower Basin Misc Bldg Conc Floor Sealer Rebar Matl Rebar Labor Lt.Wt.Insul Fill - Materials Lt.Wt.Insul Fill - Labor Submittals/Closeout Documents Supervision Clean-up								
	Div. 3 - Total Div 4 - Masonry Brickwork - Labor Brickwork - Matls Concrete Masonry - Labor Concrete Masonry - Materials Str. Glazed Tile-Labor Str. Glazed Tile-Materials Submittals/Closeout Documents Supervision Clean-up								
	Div. 4 - Total								
	Div 5 - Metals Structural Steel - Labor Structural Steel - Materials Alternating Stairs Misc. Steel - Materials Steel Joists - Materials Lt. Gauge Steel Framing-Labor Lt. Gauge Steel Framing-Matls Metal Decking - Labor Expansion Joint Covers								

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Detailing Submittals/Closeout Documents Supervision Clean-up								
	Div. 5 - Total								
	Div. 6 - Wood & Plastics Rough Carpentry - Labor Rough Carpentry - Materials Millwork - Labor Millwork - Materials Submittals/Closeout Documents								
	Div. 6 - Total								
	Div. 7 - Thermal and Moisture Protection Waterpfng / Dampprfng-Matls Waterpfng / Dampprfng-Labor Building Insulation - Labor Building Insulation - Materials Fireproofing - Labor Fireproofing - Materials Metal Roof - Labor Metal Roof - Materials Metal Roof Guarantee Built-up Roofing-Labor Built-up Roofing-Materials Built-up Roofing Guarantee Roof Accessories Building Sheet Metal - Labor Building Sheet Metal - Matls Bldg. Sheet Metal Guarantee Roof Curbs Roof Hatches Sealants Submittals/Closeout Documents Supervision Clean-up								
	Div. 7 - Total								
	Div. 8 - Doors and Frames Finish Carpentry/Door - Labor Finish Hardware - Matls Thresholds & Seals - Matls+B66 Hollow Metal Doors & Frames - Matls Plastic Faced Doors-Matls Overhead Doors & Grilles-Labor Overhead Doors & Grilles - Matls Alum. Entrances & Store-fronts - Labor								

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	fronts - Matls Alum. Windows - Labor Alum Windows - Matls Glass & Glazing-Labor Glass & Glazing-Matls Submittals/Closeout Documents Supervision Clean-up								
	Div. 8 - Total								
	Div. 9 - Finishes Lath & Plaster-Labor Lath & Plaster-Matls Gypsum Wallboard Systems - Labor Gypsum Wallboard Systems - Matls Ceramic Tile - Labor Ceramic Tile - Matls Quarry Tile - Labor Quarry Tile - Matls Terrazzo-Labor Terrazzo-Matls Acoustic Clg. - Labor Acoustic Clg. - Matls Acoustic Wall Panels Resilient Flooring - Labor Resilient Flooring - Matls Carpet - Labor Carpet - Matls Athletic Flooring - Materials Athletic Flooring - Labor Floor Sealer Painting - Labor Painting - Mtls Submittals/Closeout Documents Supervision Clean-up								
	Div. 9 - Total								
	Div. 10 - Specialties Visual Display Boards & Tackboards - Materials Visual Display Boards & Tackboards - Labor Toilet Partitions - Labor Toilet Partitions - Matls Louvers Aluminum Flag Pole Graphics Lockers Cubicle Curtains & Track Fire Extinguisher Cabinets Demountable Partitions-Labor								

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Demountable Partitions-Matls Shelving Toilet Room Accessories-Matls Toilet Room Accessories-Lbr Submittals/Closeout Documents Supervision Clean-up								
	Div. 10 - Total								
	Div. 11 - Equipment Stage Curtains Misc. Appliances Food Service Eqpt-Labor Food Service Eqpt-Matls Submittals/Closeout Documents Supervision Clean-up								
	Div. 11 - Total								
	Div. 12 - Furnishings Horizontal Blinds Projection Screens Casework - Labor Casework - Matls Science Casework - Labor Science Casework - Matls Submittals/Closeout Documents Supervision Clean-up								
	Div. 12 - Total								
	Div. 13 - Specialties Stage Curtains and Draperies Music Instrument Storage Bleachers Press Box Pre-eng. Metal Bldg. Stadium Seating Submittals/Closeout Documents Supervision Clean-up								
	Div. 13 - Total								
	Div. 14 - Conveying Systems Platform Lifts Elevators Submittals/Closeout Documents Supervision Clean-up								
	Div. 14 - Total								
	Div. 21, 22 - Plumbing Shop Drawings As-Builts/Closeout/ O&M Manuals Sanitary Underground - Labor								
Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous	This					

			App.	App.					
	Sanitary Underground - Matls								
	Storm Underground - Labor								
	Storm Underground - Matls								
	Domestic Water - Labor								
	Domestic Water - Matls								
	Plumbing Insulation - Matls								
	Plumbing Insulation - Labor								
	Gas Piping - Matls								
	Gas Piping - Labor								
	Grease Trap								
	Plumbing Fixtures - Matls								
	Plumbing Fixtures - Labor								
	Coordination Drawings								
	Submittals/Closeout Documents								
	Supervision Clean-up								
	Div. 21, 22 Plumbing - Total								
	Div. 23 - Mechanical								
	Shop Drawings								
	As-Built/Closeout/ O&M Manuals								
	Chillers - Matls								
	Chillers - Labor								
	Cooling Towers - Matls								
	Cooling Towers - Labor								
	Boilers - Matls								
	Boilers - Labor								
	AHU's - Matls								
	AHU's - Labor								
	Fans - Matls								
	Fans - Labor								
	Grilles - Matls								
	Grilles - Labor								
	Ductwork - Matls								
	Ductwork - Labor								
	Pumps - Mtls								
	Pumps - Labor								
	Water Treatment - Labor								
	Water Treatment - Matls								
	Isolation - Labor								
	Isolation - Matls								
	Pipe Flex - Matls								
	Pipe Flex - Labor								
	Connections								
	Sheet Metal - Matls								
	Sheet Metal - Labor								
	Duct Insulation - Matls								
	Duct Insulation - Labor								

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Pipe Insulation - Matls Pipe Insulation - Labor VAV Boxes - Materials VAV Boxes - Labor Refrigerant Monitor - Matls Refrigerant Monitor - Labor Unit Heaters - Materials Unit Heaters - Labor Startup Controls - Matls Control - Labor Engineer / Submittals Modules / End Devices Low Voltage Wiring Startup Closeout Documents Fire Sprinkler Engineer / Submittals Piping - Materials Piping - Labor Equipment - Materials Equipment - Labor Trimout - Materials Trimout - Labor Pipe, Valves, Fittings - Labor Pipe, Valves, Fittings - Matls Misc. - Matls Insulation - Matls Insulation - Labor Sanitary Above Slab-Labor Sanitary Above Slab-Matls Storm Above Slab - Labor Storm Above Slab - Matls Gas - Labor Gas - Matls Fixtures - Labor Fixtures - Matls Permits Coordination Drawings Submittals/Closeout Documents Supervision Clean-up								
	Div. 23 Mechanical - Total								
	Div. 26 - Electrical Mobilization+B220 Shop Drawings As-Builts/Closeout/ O&M Manuals Underground Conduit - Labor Conduit - Matl Wire - Labor								

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Wire - Matls Feeder Wire - Labor Feeder Wire - Matls Switches/Recpt. Switchgear - Labor Switchgear - Matls Temporary - Materials Temporary - Labor Gas Generator - Materials Gas Generator - Labor Fixtures - Labor Fixtures - Matls Communications - Labor Communications - Matls Fire Alarm - Labor Fire Alarm - Matls Security - Labor Security - Matls Low Voltage Ltng Sys-Matls Low Voltage Ltng Sys-Labor Voice System - Materials Voice System - Labor Video System - Materials Video System - Labor Data System - Materials Data System - Labor Master Clock - Materials Master Clock - Labor+B277 Coordination Drawings Submittals/Closeout Documents Supervision Clean-up								
	Div. 26 - Total								
	Divs. 31, 32 and 33 - Earthwork, Exterior Improvements and Utilities								
	Site Clearing & Grubbing Building Pad - Materials Building Pad - Labor Paving Subgrade Signage / Striping Bike Racks Landscaping - Materials Landscaping - Labor Hydro Mulch - Materials Hydro Mulch - Labor Irrigation - Materials Irrigation - Labor Earthwork Finish Grading Stabilization - Materials Stabilization - Labor Site Drainage - Materials Site Drainage - Labor								

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Chain Link Fence-Materials Chain Link Fence-Labor Paving - Labor Paving - Materials Sidewalks Submittals/Closeout Documents Supervision Clean-up								
	Div. 31, 32 and 33 - Total								
	General Conditions Mobilization Temp. Facilities Final Cleaning Record Documents/Closeout/ O&M Manuals Supervision Permits Bonds Insurance Allowances Alternates (list) Change Orders A. PR# B. PR# C. PR#								

END OF SECTION 01 29 73

**SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - a. General coordination procedures.
 - b. Coordination drawings.
 - c. Pre-installation meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. Requests for Information (RFI) will not be allowed from Sub-Contractors. The Contractor is to evaluate the Sub-Contractor's request and respond if the Contractor deems necessary the RFI will be forwarded to the Architect for a evaluation and response. The Contractor shall arrange the necessary meeting in the field with appropriate Architect's field representative(s) to obtain clarification as needed on items that may need interpretation, clarification and respond appropriately.

1.3 SUBMITTALS

- A. Subcontract List:
 - 1. Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - a. Name, address, and telephone number of entity performing subcontract or supplying products.
 - b. Number and title of related Specification Section(s) covered by subcontract.
 - c. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names:
 - 1. Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and the duties and responsibilities; list address, telephone numbers (home, office, and cellular), and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project:
 - a. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 COORDINATION PROCEDURES

- A. Coordinate construction operations to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation:
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include items as required notices, reports, and list of attendees at meetings:
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of the Work is required.
- C. Administrative Procedures:
 - 1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Administrative activities include, but are not limited to, the following:
 - a. Preparation of Contractor's Construction Schedule.
 - b. Preparation of the schedule of values.
 - c. Installation and removal of temporary facilities and controls.
 - d. Delivery and processing of submittals.
 - e. Progress meetings.
 - f. Pre-installation conferences.
 - g. Project closeout activities.
 - h. Startup and adjustment of systems.
 - i. Coordinating inspections and other jurisdictional requirements.
 - j. Coordinate OFCI equipment.
 - k. Action items and issue logs.
- D. Conservation:
 - 1. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste:
 - a. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to the Specifications Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

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

- 1) Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a) Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b) Coordinate the addition of trade specific information to the coordination drawings by multiple contractors in sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c) Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d) Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e) Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f) Indicate required installation sequences.
 - g) Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization:
 1. Floor plans and reflected ceiling plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan Drawings with section drawings where required to adequately represent the Work.
 2. Plenum space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures, ductwork, piping, and other components.
 3. Mechanical rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire-alarm, and electrical equipment.
 4. Structural penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab edge and embedded items: Indicate slab edge locations and sizes, and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and plumbing work - Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts, and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical work - Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.

- d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 - e. Floor boxes.
 - 8. Fire protection system - Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, sprinkler heads, and inspector test locations.
 - 9. IDF/MDF rooms: Communications and low voltage (security, data, phone, etc.) audio.
 - 10. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
 - 11. Coordination drawing prints: Prepare coordination drawing prints according to requirements in Section 01 33 00: Submittal Procedures.
- C. Coordination Digital Data Files:
- 1. Prepare coordination digital data files according to the following requirements:
 - a. File preparation format: Same digital data software program, version, and operating system as original Drawings.
 - b. File submittal format: Submit or post coordination drawing files using same format as file preparation.
 - c. BIM file incorporation:
 - 1) Develop and incorporate coordination drawing files into Building Information Model established for Project:
 - a) Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 - d. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files:
 - 1) Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - 2) Digital data software program: Drawings are available in Revit.
 - 3) Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 PROJECT MEETINGS

- A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated:
- 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Architect to prepare the meeting agenda and distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
 - 4. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
 - 5. Issue logs: Documentation element of software project management and contains a list of ongoing and closed issues of the Project.

- B. Kick-off and Preconstruction Conference:
1. Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect:
 - a. Conduct the conference to review responsibilities and personnel assignments.
 - b. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
 - c. Agenda: Discuss items of significance that affect progress.
 - d. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
 - e. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
- C. Pre-Installation Conferences:
1. Conduct a pre-installation trade conference at site before each construction activity that requires coordination with other construction trades:
 - a. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Engineer of Record of scheduled meeting dates.
 - b. Agenda: Contractor to review progress of other construction activities and preparations for the particular activity under consideration.
 - c. Contractor to record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - d. Reporting: Contractor to distribute minutes of the meeting to each party present and to other parties requiring information.
 - e. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
 - f. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
- D. Project Closeout Conference:
1. Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion:
 - a. Conduct the conference to review requirements and responsibilities related to Substantial Completion.
 - b. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
 - c. Agenda: Discuss items of significance that could affect or delay Project closeout.
 - d. Minutes: Entity conducting meeting will record and distribute meeting minutes.
 - e. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

E. Progress Meetings:

1. Conduct progress meetings at weekly intervals:
 - a. Coordinate dates of meetings with preparation of payment requests.
 - b. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
 - c. Agenda:
 - 1) Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of the Project:
 - a) Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - d. Minutes:
 - 1) Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information:
 - a) Schedule updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
 - b) Six (6) week look-ahead schedules. This may be altered to three (3) week look-ahead as part of an action item when Architect/District request:
 - i. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

F. Coordination Meetings:

1. Conduct coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences:
 - a. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with the Project and authorized to conclude matters relating to the Work.
 - b. Agenda:
 - 1) Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of the Project:
 - a) Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract

- Time.
- b) Schedule updating: Revise combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c) Review present and future needs of each contractor present.
 - c. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
 - d. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. The General Contractor will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
 - 1. All Division 01 Specification Sections.

1.02 QUALITY ASSURANCE:

- A. General:
 - 1. Attendees: The GC will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. The GC will notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: The GC will prepare the meeting agenda. The GC will distribute the agenda to all invited attendees.
 - 3. Minutes: The GC will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three [3] days of the meeting.
- B. Pre-construction Conference: The GC will schedule a pre-construction conference before starting construction, at a time convenient to Owner, District's Project Manager, and Architect, but no later than fifteen [15] days after execution of the Agreement. The GC will hold the conference at Project site or another convenient location. The GC will conduct the meeting to review responsibilities and personnel assignments.
 - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; major contractors; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Phasing. (required)
 - b. Critical work sequencing and long-lead items.

- c. Designation of key personnel and their duties.
- d. Procedures for processing field decisions and Change Orders.
- e. Procedures for RFIs.
- f. Procedures for testing and inspecting.
- g. Procedures for processing Applications for Payment.
- h. Distribution of the Contract Documents.
- i. Submittal procedures.
- j. Preparation of Record Documents.
- k. Use of the premises.
- l. Work restrictions.
- m. Responsibility for temporary facilities and controls.
- n. Construction waste management and recycling.
- o. Parking availability.
- p. Office, work, and storage areas.
- q. Equipment deliveries and priorities.
- r. First aid.
- s. Security.
- t. Progress cleaning.
- u. Working hours.
- v. Lines of Communication
- w. Compliance Items

3. Minutes: The GC will record and distribute meeting minutes.

C. Pre-Installation Conferences: The GC will conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

- 1. Attendees: The contractor must have their estimator, and the foreman that will be running the project. Also, Owner, Architect, Inspector and Consultants that are relative to the scope of work.
- 2. Agenda: The following items shall be reviewed at the Pre-Installation meetings in addition to any other contractor specific items:
 - a. Delete unnecessary items from list below. Add items to suit Project.
 - b. Schedule for the contractor and how they relate to other contractor's schedules
 - c. Contract Drawings relating to that contractor's scope of work
 - d. Contractors related specification sections
 - e. Submittals and shop drawings
 - f. Safety and competent person inspections
 - g. Review subcontractors set to confirm drawings are posted
 - h. Inspection Requests and Testing
 - i. Requirements for Daily Reports
 - j. Jobsite Rules
 - k. Related materials with other contractors
 - l. Requirements for Safety Meetings
 - m. Hours of work at the jobsite
 - n. Subcontractor Meeting dates
 - o. Accident Reporting

- p. RFI Procedures
 - q. Record Drawing requirements
 - r. Contact Information for foreman
 - s. Look Ahead Schedules
 - t. Storage Areas and Techniques.
- 3. The GC will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: The GC will distribute minutes of the meeting to each party present, and to parties who should have been present.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: The GC will conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
- 1. Attendees: In addition to representatives of Inspector and District's Project Manager, each major contractor, each subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. GC's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to GC's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Safety.
 - 2) Sequence of operations.
 - 3) Submittals.
 - 4) Deferred Approval Item.
 - 5) Status of submittals and Deferred Approval Items.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.

- 9) Site utilization.
 - 10) Temporary facilities and controls.
 - 11) Work hours.
 - 12) Hazards and risks.
 - 13) Progress cleaning.
 - 14) Quality and work standards.
 - 15) Status of correction of deficient items.
 - 16) Field observations.
 - 17) RFIs.
 - 18) Status of proposal requests.
 - 19) Pending changes.
 - 20) Status of Change Orders.
3. Minutes: The GC will record the meeting minutes.
 4. Reporting: The GC will distribute minutes of the meeting to each party present, and to parties who should have been present.
 - a. Schedule Updating: The GC will revise the GC's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. The GC will issue revised schedule concurrently with the report of each meeting.
- E. Coordination Meetings: The GC will conduct Project Coordination Meetings as required. Project Coordination Meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.
1. Attendees: In addition to representatives of Owner, District's Project Manager, and Architect, each major contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. GC's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to GC's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: The GC will revise GC's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:

- 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Coordination drawing review.
 - 4) Conflict Items.
 - 5) Resolution of conflict items.
 - 6) Access.
 - 7) Site utilization.
3. Reporting: The GC will record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 31 19.13

PRECONSTRUCTION MEETING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: To help clarify construction contract administration procedures, the Contractor will conduct a Preconstruction Conference prior to start of the Work. Provide attendance personnel directly involved with the construction of the project.
- B. Related Requirements:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 01 of these Specifications.

1.02 QUALITY ASSURANCE

- A. For those persons designated by Contractor, his subcontractors, and suppliers to attend the Preconstruction Conference, provide required authority to commit the entities they represent to solutions agreed upon in the Conference.

1.03 INFORMATIONAL SUBMITTALS

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

1.04 PRECONSTRUCTION CONFERENCE

- A. The Conference will be scheduled by the Contractor prior to actual start of the Work.
- B. Attendance:
 - 1. Provide attendance by authorized representatives of the Contractor and major subcontractors / suppliers.
 - 2. The contractor will advise other interested parties, including the Owner, and request their attendance
- C. Minimum agenda: Data will be distributed and discussed on:
 - 1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers, and the Architect.
 - 2. Channels and procedures for communication;
 - 3. Construction schedule, including sequence of critical work;
 - 4. Contract Documents, including distribution of required copies of Drawings and revisions;

5. Processing of Shop Drawings and other data submitted to the Architect for review;
6. Processing of field decisions and Change Orders;
7. Rules and regulations governing performance of the Work; and
8. Procedures for safety and first aid, security, quality control, housekeeping, and related matters.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

**SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.

1.02 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.03 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
 - 3. Four paper copies.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
 - D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
 - E. Construction Schedule Updating Reports: Submit with Applications for Payment.
 - F. Daily Construction Reports: Submit at weekly intervals.
 - G. Site Condition Reports: Submit at time of discovery of differing conditions.
- 1.04 COORDINATION
- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from entities involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

2. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 - Submittal Procedures in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 3. Startup and Testing Time: Include no fewer than 30 days for startup and testing.
 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Uninterruptible services.
 - c. Use of premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
 5. Work Stages: Indicate important stages of construction for each major portion of the Work.
 6. Other Constraints.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 15 days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.03 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.

- h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.

2.04 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.

3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events.
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00



Pre-Construction Meeting

Date: , 2025

Project location

Project Title

Address

Madera Unified School District

Prepared by: **PBK**
7790 N Palm Ave,
Fresno, California 93711

PBK Project No.: **XXXX**

Required to be Present:

Architect

Owner(s)

Project Inspector

CRM

Project Superintendent

Major Subcontractor(s)

Testing Service Representative

Bidding/Contract Requirements

- **Submission of Subcontractors list**
- **Schedule of Values**
- **Construction Schedule** (Start/Finish Dates, milestones & Critical Path). Provide (3) look ahead at each OAC Meeting.
- **Utility Permits** (PG&E, Local Fire Marshal)
- Notes: _____

Current Status of Site

- **Acceptance of Site**
- **Contractor Site Survey / Certification of grades**
- **GeoTechnical Report** (Contractor/PI - how many copies?)

General Requirements

- **Summary/Scope of work**
- **Pay Requests** (AIA format G702& G703/sample/Notary, Contractor, PI, Arch & Owner Signature) **FORM*
- **Change Procedures** (Change Order Request) **FORM* . Full breakdown of Costs attached. No Lump Sums.
Show ALL Equipment (type) Used, Materials used, Labor by trade and whether Foreman, Journeyman or Apprentice Hours. Will be checked on Dept. of Industrial Relations (DIR) Website for trade rates per county.
The District will not accept cost of trucks & workers driving to jobsite.
- **Request For Information** (review drawings/specs first with PI) **FORM*.



Be specific in your question description & location (Bldg E, gridline b & e intersection).

- **Coordination & Owner Architect Contractor (OAC) Meetings** (Bi-Weekly Meetings (DAY) @ (TIME) in Contractor Job Trailer or District Office?) Coordinate pre-installation meetings with major subs (roofing, framers, etc.)
- **Submittals** Send electronic copies to Architect and must have Complete Information
- **Construction Requirements for start-up of equipment** (facilities/controls provided by owner)
- **Product Substitutions** (submit each request separately with a comparison of key product values) *FORM
- **Contract Close-out Documentation** (Punch List Inspection/Final Cleaning/Project Record Documents/Operation & Maintenance Manuals/Warranties/Spare Parts and Maintenance Materials)
- **Jobsite Work Hours Set** Provide start work hours and stop work hours. If something special is required District must be made aware prior to any changes so we can alert School Staff & Students and any neighbors that may be affected. This includes late night delivery of supplies or equipment. Hours are:_____
- **Separation of Work Zone & Workers** Provide fencing to separate construction work area. Fencing will be locked during non-working hours. Discuss separation of workers from School Staff & Students. No music boxes/truck music, No clothing with improper graphics/messages, No Foul Language. Separation zones for lunch breaks and separate workers toilets.
- **Special Testing and Inspection Services.** Provide at least 48 hours notice to Special Inspection Team. Show Inspections on Schedule.
- **DSA Involvement** (DSA Field Inspector & Project Inspector - Observe & Report that construction matches approved construction documents. If not compliant a Deviation Notice may be filed.)
- **Jobsite Safety** This is a very high priority issue. All OSHA Safety Standards will be observed. Safety Gear Shall be worn period! Provide safety meeting with all workers so when an accident occurs they know what to do and where to go for help. Location of First Aid Kit, Emergency number to call for local medical help.
- **NO Tobacco Products, Smoking/Vaping or Drugs of ANY Kind** General & Major Subs are held responsible for all workers to obey these rules on the project. No Smoking in Toilets Period. Anyone found breaking these rules will be dismissed from working on this project.
- **Jobsite Clean of all Trash** This will help Safety too.
- **Questions on what we just discussed or that need to be covered?** (General, Subcontractors, IOR, Owner)

END OF SECTION 01 32 10

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 01 32 00 - Construction Progress Documentation for submitting schedules and reports, including Contractor's construction schedule.
 - 2. Section 01 78 23 - Operation and Maintenance Data for submitting operation and maintenance manuals.
 - 3. Section 01 78 39 - Project Record Documents for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 01 79 00 - Demonstration and Training for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.02 DEFINITIONS

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

1.03 ACTION SUBMITTALS

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

1.04 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.

- c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
- a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
- a. Transmittal Form for Paper Submittals: Use AIA Document G810.
 - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect.
 - 6) Name of Contractor.
 - 7) Name of firm or entity that prepared submittal.
 - 8) Names of subcontractor, manufacturer, and supplier.
 - 9) Category and type of submittal.
 - 10) Submittal purpose and description.
 - 11) Specification Section number and title.
 - 12) Drawing number and detail references, as appropriate.
 - 13) Indication of full or partial submittal.
 - 14) Signature of transmitter.

- E. Options: Identify options requiring selection by Architect.
- F. Deviations: Identify deviations from the Contract Documents on submittals.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements:
 - 1. Action Submittals: Submit 6 paper copies of each submittal unless otherwise indicated. Architect will return 2 copies.
 - 2. Informational Submittals: Submit 6 paper copies of each submittal unless otherwise indicated. Architect will not return copies.
 - 3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.

- b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
- 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before or concurrent with Samples.
- 6. Submit Product Data in the following format:
 - a. 6 paper copies of Product Data unless otherwise indicated. Architect will return two copies.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 - 3. Submit Shop Drawings in the following format:
 - a. 6 opaque (bond) copies of each submittal. Architect will return 2 copies.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these

characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit 3 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain 1 Sample sets; remainder will be returned.

- 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Submit product schedule in the following format:
 - a. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 - Construction Progress Documentation.
- G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 - Closeout Procedures.
- H. Maintenance Data: Comply with requirements specified in Section 01 78 23 - Operation and Maintenance Data.
- I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

- P. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- R. Schedule of Tests and Inspections: Comply with requirements specified in Section 01 40 00 - Quality Requirements.
- S. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- T. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- U. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- V. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 - Closeout Procedures.
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement

certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 WORK SPECIFIED HEREIN

- A. All requirements and procedures for submittal of shop drawings, product data and samples required for all work on the project. This Section is complementary to General Conditions and Supplementary General Conditions and nothing herein shall be considered to waive any requirements of the General Conditions or Supplementary General Conditions.

1.02 GENERAL

- A. Provide shop drawings, product data and samples specified herein in accordance with the following requirements. General Contractor shall review shop drawings prior to submission to the Architect, stamp such drawings with his/her own review stamp, then submit to Architect.
- B. Submit shop drawings, material lists, manufacturer's literature, samples and other required information in sufficient time to permit proper consideration and action on same before any materials or items, which such shop drawings, information and samples represent, are ordered. Allow sufficient time so that no delay occurs due to required lead time in ordering or delivery to the job site.
- C. The General Contractor will be held responsible for any delay in progress of the work due to his failure to observe these requirements. Time for completion of the Contract for Construction will not be extended on account of his failure to promptly submit shop drawings, product data and samples.
- D. After review by the Architect will keep 2 copies and return the rest of the copies to the General Contractor.

PART 2 - PRODUCTS

2.01 SHOP DRAWINGS, PRODUCT DATA

- A. Furnish to the Architect, for review, on reproducible sepia transparency and 4 prints of each sheet of shop (or setting) drawings and schedules for parts of the work as specified or required (6 prints are acceptable alternate). Allow ample time for Architect's comments and review. The Architect will correct, annotate, clarify, or amplify said sepias or, at his option, require the General Contractor to do so. After Architect has reviewed the submission, he will obtain such prints as he requires for his use and transmit sepias and one marked print to the General Contractor. General Contractor shall obtain, at his cost, whatever prints he

required for his purposes and distribute same. Sepias remain property of the General Contractor. Reproduction of Contract Documents will not be accepted.

- B. Each shop drawing submittal shall be accompanied by 2 copies of General Contractor's "Transmittal Form", signed by General Contractor. Do not execute work required by shop drawings until confirmation of review is obtained. Submit shop drawings and details sufficiently in advance of the work which they cover, and in accordance with a prearranged schedule, to afford ample time for checking, correcting and rechecking, if necessary, for such drawings and details.
- C. Before submitting shop drawings for review, General Contractor shall check shop drawings of Subcontractors for accuracy, ascertain that all work contiguous with and having bearing on other work shown on shop drawings is accurately drawn, and that work done is in conformity with Contract Documents.
- D. All such drawings and details, when submitted, must bear the stamp of approval of General Contractor, bearing checked data, as evidence that such drawings and details have been checked by him. Said "stamp" shall clearly state that the General Contractor has checked the drawings, and, by his signature, he so certifies. Any drawings submitted without such executed stamp of approval, or whenever it is evident (despite the stamp) that the drawings have not been checked, they will be returned to the General Contractor for re-submission and will not be considered. In such event, it will be deemed that General Contractor has not complied with this provision and the General Contractor shall bear risk of all delays to the same extent as if no drawings or details at all had been submitted.
- E. The General Contractor shall prepare composite drawings and installation layouts, when required to solve tight field conditions. Such drawings shall consist of dimensioned plans and elevations, and must give complete information particularly as to size and location of sleeves, inserts, attachments, openings, conduits, ducts, boxes, structural interferences, etc. These composite drawings and installation layouts shall be coordinated in the field by the General Contractor and his Subcontractors for proper relationship to the work of other trades, based on field conditions, and shall be checked and approved by them before submission to the Architect for his final review. The General Contractor shall have competent technical personnel readily available for such coordinating and checking, as well as for supervision of field installation of work as per the drawings and installation layouts, which have been previously determined by him to be correct and carry the Architect's review stamp.
- F. Submission of shop drawings (in wither original submission or when resubmitted with corrections) constitute evidence that the General Contractor has checked all information thereon, and that he accepts and is willing to perform the work as shown in a workmanlike manner and in accordance with nest standard practice. No claim for an addition to the Contract Sum shall be based on work shown on shop drawings, unless such claim is noted in General Contractor's Transmittal Form accompanying the shop drawings.
- G. Cost of any changes in construction due to improper checking and coordination by the General Contractor shall be paid for by him, and the General Contractor shall be responsible for all additional costs, including coordination.

- H. Shop drawings shall clearly delineate the following information:
1. Architects name and project number, Project name and address.
 2. Drawing title, number, date and scale.
 3. Names of General Contractor, Subcontractor and fabricator.
 4. Working and erection dimensions.
 5. Arrangements and sectional views.
 6. Necessary details, including complete information for making connections with other work.
 7. Kinds of materials and finishes.
 8. Applicable specification reference number.
 9. 5" x 3" space for General Contractor's and Architect's stamps.
- I. If shop drawings show variations from Contract documents because of standard shop practice or other reasons, make specific mention of such variations in Transmittal Form.
- J. Shop drawing review will be general. It shall not relieve the General Contractor of responsibility for accuracy of such shop drawings, nor proper fitting, construction of work, furnishing of materials, or work required by Contract Documents and not indicated on shop drawings. Shop drawing approval shall not be construed as approving departures from Contract Documents.
- K. Review of shop drawings and schedules shall not relieve the General Contractor from responsibility for any violation indicated on such drawings or schedules of local, county, state or federal laws, rules, ordinances, or rules and regulations of commissions, boards or other authorities or utilities having jurisdiction.
- L. When product data, consisting of manufacturer's printed literature is required to be submitted to Architect, it shall be submitted in original form. Any fading type of reproduction will not be accepted. A minimum of 3 each is required; 2 for Architect and one to be returned to General Contractor, who shall submit whatever additional copies he required for his distribution.

2.02 SAMPLES

- A. Deliver no material to the building site prior to receipt of Architect's written approval. Furnish materials equal in every respect to approved samples and execute work in conformity therewith.
- B. The approval or acceptance of samples will not preclude the rejection of any material upon the discovery of defects in same prior to the final acceptance of the completed work.
- C. After a material has been approved, no change in brand or make will be permitted unless satisfactory written evidence is presented to, and approved by the Architect that the manufacturer cannot make schedules delivery of approved material, or that material delivered has been rejected and substitution of suitable material is an urgent necessity, or that other conditions are apparent which indicate approval of such substitute materials to be in best interest of Owner.

- D. All samples of materials requiring laboratory tests shall be submitted to laboratory for testing not less than 90 days before such materials are required to be used in the work. Submit all other samples for approval within 30 days after signing of the Contract Documents.
- E. Submit samples, in duplicate, except where greater or lesser number is specifically required by these Specifications. Submittal shall be made only by the General Contractor, unless he has authorized his Subcontractor to submit them and has notified the Architect to this effect. Ship all samples prepaid.
- F. Samples will receive consideration only when accompanied by 2 copies of General Contractor's "Transmittal Form" signed by the General Contractor.
- G. The transmittal shall contain list of samples, Project, General Contractor, manufacturer, brand, quarry, quality, etc.; also, job number, specifications reference, ASTM or FS number (if any) and material being furnished. Enclose copies of transmittal with samples. Any deviations from Contract for Construction requirements shall be so stated in the transmittal.
- H. Label each sample to indicate Project, General Contractor, manufacturer, brand, quality, etc.; also, job number, ASTM or FS number (if any). Samples which are rejected by the Architect must be resubmitted as soon as possible after notification of rejection and shall be marked "Resubmitted Sample" in addition to other information required.
- I. The right is reserved to require submission of samples of any material or any material lists whether or not specifically specified in the Specifications.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 REFERENCE

- A. Requirements in Addenda, Alternates, Conditions and Division 01 collectively apply to this work.
- B. Applicable Sections of Title 21 California Code of Regulations (CCR) also apply to all work.

1.02 DESCRIPTION

- A. Principal Work Items Are:
 - 1. Tests and inspections required per T&I list.
- B. Related Work Specified Elsewhere:
 - 1. Work to be tested or inspected: Respective Sections.

1.03 TESTS AND INSPECTIONS – GENERAL

- A. General:
 - 1. Tests and Inspections: 24 CCR and 17A.
- B. Contractor: Shall furnish labor, materials, and equipment and perform all operations required to take and prepare test samples, as required for inspection of all work.
- C. Payment of Tests and Inspection Costs:
 - 1. District: The District will pay all costs for required testing and inspection of both on-site and off-site work, except where specifically noted otherwise.
 - 2. Costs to be reimbursed to the District by Contractor:
 - a. Cost of testing materials, which fail to meet requirements of Contract Documents.
 - b. Overtime Costs: Whenever Contractor elects to work during hours other than normal work week and laboratory inspection is required, District will pay normal cost of laboratory inspection and Contractor shall pay that portion of laboratory inspection cost due to overtime.
 - c. Where specifically noted.

1.04 TESTING AGENCY

- A. All tests shall be made by a well-established, independent testing laboratory(ies) selected by the District and approved by DSA.

1.05 RESULTS

- A. Test Reports:

- 1. Testing laboratory to report result of all tests in writing.
- 2. Reports shall state that:
 - a. Tests were made under responsible charge of a Testing Engineer, licensed to practice Civil Engineering, State of California.
 - b. Materials(s) were tested per requirements of Contract Documents and Division of State Architect.
 - c. Materials(s) Passed or Failed to Pass requirements.

- 3. Report(s), Distribution:

Architect.....	2 copies
Structural Engineer.....	1 copy
Inspector.....	1 copy
Contractor.....	1 copy
Division of the State Architect	1 copy

- B. Certification: Upon completion of the work, Testing Laboratory shall furnish notarized certificate to Division of State Architect stating:

- 1. Tests for the work were made per requirements of Contract Documents and Division of State Architect.
- 2. All such tests and reports made for the work were reported.

1.06 REQUIRED TESTS AND INSPECTIONS

- A. General: Tests and inspections are referenced to Specification Divisions and Sections.

- B. Division 31 - Earthwork:

- 1. General:
 - a. Conform to Title 24 CCR.
 - b. Tests, inspections, and certifications performed by Registered Soils Engineer, selected by District, for designated site areas requiring Laboratory control.
- 2. Test and determine acceptability of fill material, prior to placement.
- 3. Observe placement of fill.
- 4. Test compacted fill.

- a. Conform to Division of the State Architect requirements.
- b. Test per ASTM D-1557-78, as follows:
 - 1) Test Cylinder.
 - 2) Hammer: 2" diameter; 10 lbs.
 - 3) Compact earth in cylinder in five layers: 25-18" drop hammer blows per layer.

5. Reports:

- a. Report all tests.
- b. File Verified Reports with Division of the State Architect.

6. Certification Letter: Upon completion of work, state that compacted fill:

- a. Conforms to requirements of Contract Documents, Division of the State Architect, and Soils Report.
- b. Is adequate for loads to be carried.

7. Section 32 12 16 - Asphaltic Concrete Paving.

C. Building Materials:

- 1. All building materials used in this project must conform to the testing and installation standards of the current C.B.C. as published by I.C.C.

1.07 TESTS

- A. The District will select an independent testing laboratory to conduct the tests. Selection of the material required to be tested shall be by the laboratory or the District's representative and not by the Contractor.
- B. The Contractor shall notify the District's representative a sufficient time in advance of the manufacture of material to be supplied by him under the Contract Documents, which must, by terms of the Contract, be tested in order that the District may arrange for the testing of same at the source of supply.
- C. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.
- D. The District will select and pay testing laboratory costs for all tests and inspections but may be reimbursed by the Contractor for such costs under the Contract Documents.

1.08 TESTS REPORTS

- A. One copy of all test reports shall be forwarded to the Division of the State Architect by the testing agency. Such reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or

unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of the California Building Code and any other regulating standards as required by law and with the approved Specifications. Test reports shall show the specified design strength. They shall also state definitely whether or not the material or materials tested comply with requirements.

1.09 VERIFICATION OF TEST REPORTS

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

1.10 INSPECTION BY THE DISTRICT

- A. The District and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for each inspection.
- B. The District shall have the right to reject materials and workmanship which are defective, or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the District. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the District may correct same and charge the expense to the Contractor.
- C. Should it be considered necessary or advisable by the District at any time before final acceptance of the entire work to make any examination of the work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to the fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

1.11 INSPECTOR – DISTRICT'S

- A. An Inspector employed by the District and approved by DSA in accordance with the requirements of the California Code of Regulations, Title 21 and 22, will be assigned to the work. His duties are as specifically defined in the California Code of Regulations.
- B. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector

reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.

1.12 INSPECTOR – DISTRICT – FIELD OFFICE

- A. The Contractor shall provide for the use of the District's Inspector a temporary office to be located as directed by the Inspector and to be maintained until removal is authorized by the District. This office shall be of substantial waterproof construction with adequate natural light and ventilation by means of stock design windows. The door shall have a lock. A table satisfactory for the study of plans and two chairs shall be provided by the Contractor. The Contractor shall provide and pay for adequate electric lights, private local telephone service with a long exterior bell, and adequate heat and air conditioning for this field office until the completion of the Contract. In the case of break-in and vandalism to inspector's trailer and loss of I.O.R., privately owned office machines, the Contractor shall reimburse I.O.R. for loss or replace of kind.

END OF SECTION

**SECTION 01 42 00
REFERENCES**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. General: This Section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include the obtaining of permits, licenses, inspections, releases, and similar statements, as well as payments, associated with regulations, codes, and standards.
- B. Governing Regulations:
 - 1. Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations:
 - a. The Division of the State Architect (DSA), State of California provides design and construction oversight for this Project and as such is subject to the rules and regulations.

1.3 DEFINITIONS

- A. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, approved is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- B. Basic Contract: Definitions are included in the Conditions of the Contract.
- C. Directed: A command or instruction by Architect. Other terms including requested, authorized, selected, required, and permitted have the same meaning as directed.
- D. Furnish: Supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- E. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including shown, noted, scheduled, and specified have the same meaning as indicated.
- F. Install: Operations at the Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- G. Project Site: Space available for performing construction activities. The extent of the Project site is shown on Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- H. Provide: Furnish and install, complete and ready for the intended use.
- I. Regulations: Includes laws, statutes, ordinances, and lawful orders issued by governing authorities, as well as those rules, conventions, and agreements within the construction industry that effectively control the performance of the Work regardless of whether they are

lawfully imposed by a governing authority or not.

- J. Testing Agencies: An independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, to report on and, if required, to interpret results of those inspections or tests.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference. Individual Specification Sections indicate which codes and standards Contractor must keep available at the Project site for reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two (2) or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to Architect/Engineer for a decision before proceeding.
- D. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified is intended to be the minimum for the Work to be provided or performed. Unless otherwise indicated, the actual Work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to Architect/Engineer for decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision:
1. AABC - Associated Air Balance Council; www.aabc.com.
 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 3. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 4. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 5. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 6. ACI - American Concrete Institute (formerly ACI International); www.concrete.org.
 7. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 8. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 9. AGA - American Gas Association; www.aga.org.
 10. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 11. AI - Asphalt Institute; www.asphaltinstitute.org.
 12. AIA - American Institute of Architects (The); www.aia.org.
 13. AISC - American Institute of Steel Construction; www.aisc.org.
 14. AISI - American Iron and Steel Institute; www.steel.org.

15. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
16. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
17. ANSI - American National Standards Institute; www.ansi.org.
18. APA - The Engineered Wood Association; www.apawood.org.
19. APA - Architectural Precast Association; www.archprecast.org.
20. API - American Petroleum Institute; www.api.org.
21. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
22. ASCE - American Society of Civil Engineers; www.asce.org.
23. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
24. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
25. ASME - ASME International (American Society of Mechanical Engineers); www.asme.org.
26. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
27. ASSP - American Society of Safety Professionals (The); www.assp.org.
28. ASTM - ASTM International (American Society for Testing and Materials International); www.astm.org.
29. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
30. AWI - Architectural Woodwork Institute; www.awinet.org.
31. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
32. AWWPA - American Wood Protection Association (formerly American Wood-Preservers' Association); www.awpa.com.
33. AWS - American Welding Society; www.aws.org.
34. AWWA - American Water Works Association; www.awwa.org.
35. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
36. BIA - Brick Industry Association (The); www.gobrick.com.
37. BICSI - BICSI, Inc.; www.bicsi.org.
38. BIFMA - BIFMA International (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
39. BOCA - BOCA (Building Officials and Code Administrators International Inc.); (See ICC).
40. CEA - Consumer Electronics Association; www.ce.org.
41. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
42. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
43. CGA - Compressed Gas Association; www.cganet.com.
44. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
45. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
46. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
47. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
48. CPA - Composite Panel Association; www.pbmdf.com.
49. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
50. CRRC - Cool Roof Rating Council; www.coolroofs.org.
51. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
52. CSA - Canadian Standards Association; www.csa.ca.
53. CSA - CSA International (formerly IAS - International Approval Services); www.csa-international.org.
54. CSI - Construction Specifications Institute (The); www.csinet.org.
55. CTI - Cooling Technology Institute (formerly Cooling Tower Institute); www.cti.org.
56. CWC - Composite Wood Council; (See CPA).
57. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
58. DHI - Door and Hardware Institute; www.dhi.org.
59. DSA - Division of the State Architect, State of California.

60. ECA - Electronic Components Association; www.ec-central.org.
61. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
62. EIA - Electronic Industries Alliance; (See TIA).
63. EIMA - EIFS Industry Members Association; www.eima.com.
64. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
65. ESD - ESD Association (Electrostatic Discharge Association); www.esda.org.
66. ESTA - Entertainment Services and Technology Association; (See PLASA).
67. EVO - Efficiency Valuation Organization; www.evo-world.org.
68. FM Approvals - FM Approvals LLC; www.fmglobal.com.
69. FM Global - FM Global (formerly FMG - FM Global); www.fmglobal.com.
70. FSC - Forest Stewardship Council U.S.; www.fscus.org.
71. GA - Gypsum Association; www.gypsum.org.
72. GANA - Glass Association of North America; www.glasswebsite.com.
73. GS - Green Seal; www.greenseal.org.
74. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
75. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
76. HPW - H.P. White Laboratory, Inc.; www.hpwhite.com.
77. ICBO - International Conference of Building Officials; (See ICC).
78. ICC - International Code Council; www.iccsafe.org.
79. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
80. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
81. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
82. IEC - International Electrotechnical Commission; www.iec.ch.
83. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
84. IES - Illuminating Engineering Society (formerly Illuminating Engineering Society of North America); www.ies.org.
85. IESNA - Illuminating Engineering Society of North America; (See IES).
86. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
87. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
88. IGSHPA - International Ground Source Heat Pump Association;
www.igshpa.okstate.edu.
89. Intertek - Intertek Group (formerly ETL SEMCO; Intertek Testing Service NA);
www.intertek.com.
90. ISA - International Society of Automation (The) (formerly Instrumentation, Systems,
and Automation Society); www.isa.org.
91. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
92. ISFA - International Surface Fabricators Association (formerly International Solid
Surface Fabricators Association); www.isfanow.org.
93. ISO - International Organization for Standardization; www.iso.org.
94. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
95. ITU - International Telecommunication Union; www.itu.int/home.
96. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
97. LMA - Laminating Materials Association; (See CPA).
98. LPI - Lightning Protection Institute; www.lightning.org.
99. MBMA - Metal Building Manufacturers Association; www.mbma.com.
100. MCA - Metal Construction Association; www.metalconstruction.org.
101. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
102. MHIA - Material Handling Industry of America; www.mhia.org.
103. MIA - Marble Institute of America; www.marble-institute.com.
104. MMPA - Moulding & Millwork Producers Association (formerly Wood Moulding &
Millwork Producers Association); www.wmmpa.com.
105. MPI - Master Painters Institute; www.paintinfo.com.
106. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry
Inc.; www.mss-hq.org.
107. NAAMM - National Association of Architectural Metal Manufacturers;
www.naamm.org.

- 108. NACE - NACE International (National Association of Corrosion Engineers International); www.nace.org.
- 109. NADCA - National Air Duct Cleaners Association; www.nadca.com.
- 110. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
- 111. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
- 112. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
- 113. NCMA - National Concrete Masonry Association; www.ncma.org.
- 114. NEBB - National Environmental Balancing Bureau; www.nebb.org.
- 115. NECA - National Electrical Contractors Association; www.necanet.org.
- 116. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
- 117. NEMA - National Electrical Manufacturers Association; www.nema.org.
- 118. NETA - InterNational Electrical Testing Association; www.netaworld.org.
- 119. NFHS - National Federation of State High School Associations; www.nfhs.org.
- 120. NFPA - NFPA (National Fire Protection Association); www.nfpa.org.
- 121. NFPA - NFPA International; (See NFPA).
- 122. NFRC - National Fenestration Rating Council; www.nfrc.org.
- 123. NHLA - National Hardwood Lumber Association; www.nhla.com.
- 124. NLGA - National Lumber Grades Authority; www.nlga.org.
- 125. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
- 126. NRCA - National Roofing Contractors Association; www.nrca.net.
- 127. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
- 128. NSF - NSF International (National Sanitation Foundation International); www.nsf.org.
- 129. NSPE - National Society of Professional Engineers; www.nspe.org.
- 130. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
- 131. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
- 132. NWFA - National Wood Flooring Association; www.nwfa.org.
- 133. PDI - Plumbing & Drainage Institute; www.pdionline.org.
- 134. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
- 135. RFCI - Resilient Floor Covering Institute; www.rfci.com.
- 136. RIS - Redwood Inspection Service; www.redwoodinspection.com.
- 137. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
- 138. SDI - Steel Deck Institute; www.sdi.org.
- 139. SDI - Steel Door Institute; www.steeldoor.org.
- 140. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
- 141. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
- 142. SIA - Security Industry Association; www.siaonline.org.
- 143. SJI - Steel Joist Institute; www.steeljoist.org.
- 144. SMA - Screen Manufacturers Association; www.smainfo.org.
- 145. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
- 146. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
- 147. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
- 148. SPIB - Southern Pine Inspection Bureau; www.spib.org.
- 149. SPRI - Single Ply Roofing Industry; www.spri.org.
- 150. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
- 151. SSINA - Specialty Steel Industry of North America; www.ssina.com.
- 152. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
- 153. STI - Steel Tank Institute; www.steeltank.com.
- 154. SWI - Steel Window Institute; www.steelwindows.com.
- 155. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
- 156. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
- 157. TCNA - Tile Council of North America, Inc. (formerly Tile Council of America); www.tileusa.com.

158. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
 159. TIA - Telecommunications Industry Association (formerly TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
 160. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
 161. TMS - The Masonry Society; www.masonrysociety.org.
 162. TPI - Truss Plate Institute; www.tpinst.org.
 163. TPI - Turfgrass Producers International; www.turfgrasssod.org.
 164. TRI - Tile Roofing Institute; www.tilerroofing.org.
 165. UBC - Uniform Building Code; (See ICC).
 166. UL - Underwriters Laboratories Inc.; www.ul.com.
 167. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 168. USAV - USA Volleyball; www.usavolleyball.org.
 169. USGBC - U.S. Green Building Council; www.usgbc.org.
 170. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 171. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 172. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 173. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 174. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 175. WI - Woodwork Institute (formerly WIC - Woodwork Institute of California); www.wicnet.org.
 176. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
 177. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 178. WPA - Western Wood Products Association; www.wwpa.org.
- B. Standards and Regulations - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations:
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. FED-STD - Federal Standard; (See FS).
 3. USAB - United States Access Board; www.access-board.gov.
 4. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- C. Code Agencies - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the Agency:
1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 2. ICC - International Code Council; www.iccsafe.org.
 3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- D. State Government Agencies - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents:
1. CBHF - State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR - California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS - California Department of Health Services; (See CDPH).
 4. CDPH - California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC - California Public Utilities Commission; www.cpuc.ca.gov.
 6. CBC – California Building Code (2022 Edition).

7. CEC – California Electrical Code (2022 Edition).
8. CMC – California Mechanical Code (2022 Edition).
9. CFC – California Fire Code (2022 Edition).

1.6 SUBMITTALS

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 42 00

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 – Summary for work restrictions and limitations on utility interruptions.

1.02 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.03 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

- C. Fire-Safety Program: Show compliance with requirements of NFPA 241, 2010 CFC Chapter 14 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.04 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.05 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails , with galvanized barbed-wire top strand.

2.02 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Inspector of Record office and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.03 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures (minimum 2A:10B:C).

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 01 10 00 – Summary.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel.
- F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high

humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead unless otherwise indicated.
 - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 - 1. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- L. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications. Equip computer with not less than the following:
 - 1. Processor: Intel Pentium D or Intel CoreDuo, 3.0 GHz processing speed.
 - 2. Memory: 4 gigabyte.
 - 3. Disk Storage: 300 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
 - 4. Display: 22-inch LCD monitor with 128 Mb dedicated video RAM.
 - 5. Network Connectivity: 10/100BaseT Ethernet.
 - 6. Productivity Software:
 - a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.

- b. Adobe Reader 7.0 or higher.
- 7. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
- 8. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
- 9. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.

3.03 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations and Fire Department access.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 20 00 - Earthwork.
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 12 16 - Asphalt Concrete Paving.
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Provide temporary parking areas for construction personnel.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
- H. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 - Construction Waste Management and Disposal.
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 74 23 - Cleaning.
- J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Section 31 11 00 - Site Clearing and Grubbing.
- D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
- E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241A and 2010 CFC Chapter 14; manage fire prevention program.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.05 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

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1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Discard or replace water-damaged and wet material.
 4. Discard, replace, or clean stored or installed material that begins to grow mold.
 5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.06 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 - Closeout Procedures.

END OF SECTION

SECTION 01 57 00 – FUGITIVE DUST CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Provide all material, labor, fees, and services necessary to comply with the San Joaquin Valley Air Pollution Control District (SJVAPCD) Regulation VIII for dust control requirements.
 - 2. Contractor will determine the total disturbed surface area and the estimated bulk material moving volumes anticipated for the Project to determine if a Construction Notification or Dust Control Plan is required. Contractor shall prepare and submit a Construction Notification or Dust Control Plan to the SJVAPCD based on these expected Project conditions/activities.
 - 3. Non-residential Projects that will include five acres or more of disturbed surface area and/or will be moving, depositing, or relocating more than 2,500 cubic yards of bulk material on at least three days of the project are required to submit a Dust Control Plan to the SJVAPCD and receive approval prior to commencing earth moving activities.
 - 4. Non-residential projects that will include less five acres of disturbed surface area must submit a Construction Notification at least 48 hours prior to commencement of any earthmoving activities. No approval or response from the SJVAPCD is required.
 - 5. Contractor shall be solely responsible for payment of any fees or fines related to violations of SJVAPCD Regulation VIII from Project activities/conditions.
 - 6. All Contract requirements in Division 00 and 01 specifications.
- B. This Section does not include:
 - 1. None.
- C. Acronyms:
 - 1. SJVAPCD San Joaquin Valley Air Pollution Control District

1.2 REFERENCES

- A. SJVAPCD Compliance Assistance Web Page on Dust Control:
 - 1. <https://ww2.valleyair.org/compliance/dust-control/>
- B. SJVAPCD Regulation VIII
 - 1. <https://ww2.valleyair.org/rules-and-planning/current-district-rules-and-regulations/regulation-viii-fugitive-pm10-prohibitions/>

1.3 RELATED SECTIONS

- A. Section 31 11 00 – Site Clearing
- B. Section 31 20 00 – Earthwork
- C. Section 01 57 23 – Stormwater Pollution Prevention Plan

1.4 SUBMITTALS

- A. If applicable, Contractor shall submit to the SJVAPCD the Project Dust Control Plan at

least 30 days prior to commencing earth moving activities.

- B. If applicable, Contractor shall submit to the SJVAPCD the Project Construction Notification at least 48 hours prior to commencing earth moving activities.
- C. Contractor shall submit to Owner the Project Dust Control Plan approved by the SJVAPCD or documentation of submission of a Construction Notification to SJVAPCD prior to commencing earth moving activities.

1.5 REQUIREMENTS

- A. Comply with all requirements of SJVAPCD Regulation VIII throughout the life of this contract.
- B. The Contractor shall be fully aware of the requirements of SJVAPCD Regulation VIII, the requirements of these specifications for preparing, implementing, maintaining, and enforcing the provisions of SJVAPCD Regulation VIII, and the impact that Regulation VIII will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost. Failure to comply with SJVAPCD Regulation VIII is a violation of local regulations. Contractor hereby agrees to indemnify, defend and hold harmless Owner, its officers, agents, and employees from and against any and all claims, demands, losses or liabilities of any kind or nature which Owner, its officers, agents, and employees may sustain or incur for noncompliance with the Regulation VIII arising out of or in connection with the Project, except for liability resulting from the negligence or willful misconduct of Owner, its officers, agents or employees. Owner may seek damages from Contractor for delay in completing the Project in accordance herewith, including damage caused by Contractor's failure to comply with Regulation VIII requirements.

1.6 QUALITY ASSURANCE

- A. None.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Dust Management Practices (DMPs):
 - 1. The Contractor is responsible for the providing and furnishing all DMPs, products, and practices necessary to comply with Regulation VIII. All materials and DMPs shall follow the requirements outlined in Regulation VIII, Rule 8021.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Dust Control Training Class Certificate:
 - 1. At least one key individual representing the Contractor who prepares a Dust Control Plan must complete a Dust Control Training Class conducted by the SJVAPCD.
 - 2. At least one key individual representing the Contractor who is tasked to implement the Dust Control Plan must complete a Dust Control Training Class conducted by the SJVAPCD.

3.2 CLEANING AND REMOVAL

- A. All temporary DMPs shall be completely removed from the Project Site upon completion of

construction.

3.3 RECORD KEEPING

- A. If a Dust Control Plan applies to the Project, Contractor shall maintain records in accordance with the recordkeeping requirements of Regulation VIII, Rule 8011.

3.4 PAYMENT

- A. Full compensation for all costs involved in preparing, submitting, implementing, and monitoring the implementation of Regulation VIII for this project, including training, performing corrective measures, providing all labor, materials, resources to maintain the site, and all required records for a Dust Control Plan (if applicable), and being full liable for all failures to fulfill the intent and requirements of the Regulation VIII set forth by the SJVAPCD, shall be included in the cost bid for the various items of work and no additional payment will be made therefor.

END OF SECTION 01 57 00

SECTION 01 57 13 EROSION CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

- A. General: Provide all materials, equipment and labor necessary to furnish and install straw wattles at locations shown on the Drawings and on Contractors Storm Water Pollution Prevention Plan.
- B. Storm Water Pollution Prevention Plan: Contractor will be required to prepare a Storm Water Pollution Prevention Plan (SWPPP), and submit to the State Water Resource Control Board to obtain Notice of Intent approval and a WDID number. Comply with State Water Resources Control Board requirements. The SWPPP shall be provided by the Contractor prior to the start of work. The SWPPP shall be tailored to the contractor's approach to the work in this contract. The SWPPP shall be prepared by a Qualified SWPPP Developer (QSD). The Contractor shall as a minimum address:
 - 1. Cut and fill operations.
 - 2. Temporary stockpiles.
 - 3. Vehicle and equipment storage, maintenance and fueling operations.
 - 4. Concrete, plaster, mortar and paint disposal.
 - 5. Dust control.
 - 6. Tracking of dirt, mud on off-site streets.
 - 7. Erosion Controls
 - 8. Sediment Controls

1.3 SUBMITTALS

- A. SWPPP: Contractors Qualified SWPPP Developer (QSD) shall submit to the State Water Resources Control Board via Storm water Multi Application and Report Tracking System (SMARTS) and obtain a Notice of Intent and WDID number prior to beginning work on site.

1.4 QUALITY ASSURANCE

- A. General: Comply with governing codes and regulations.

PART 2 PRODUCTS

2.1 MATERIALS

- A. A. Straw Wattles: Shall be new manufactured straw rolls in compliance with state requirements for sediment control.
- B. Hydroseed: Shall be a 3 step seeding rate consisting of:
 - 1. Step 1:
 - 2. Fiber Mulch @ 500 lbs/ac
 - 3. Fertilizer (16-20-0) @ 250lbs/ac
 - 4. Tacikfier (Plantago) @ 50lbs/ac

5. Seed (Blandon Brome) @ 12lbs/ac
6. Seed (Annual Rye) @ 9lbs/ac
7. Step 2:
8. Blown Straw @ 3500lbs/ac
9. Step 3:
10. Fiber Mulch @ 500lbs/ac
11. Tacikfier (Plantago) @ 200lbs/ac

PART 3 EXECUTION

3.1 INSTALLATION

- A. All BMPS shall be installed per the drawings, CASQA standards and as required by the SWPPP.

3.2 MAINTENANCE AND REMOVAL:

- A. General: Maintain and repair existing and new erosion control facilities throughout the construction period. Remove silt build up at straw wattles and/or silt fences as needed. Repair damage to earth slopes and banks. Erosion control measures shall be left in place until hydroseed is placed.
- B. Monitoring: Based on determined Risk Level of Contractor's SWPPP provide monitoring of erosion and sediment control measures before, during and after storm events. Site monitoring shall be performed by a Qualified SWPPP Practitioner. Update SWPPP continuously throughout construction period and provide reporting and testing as required by the current NPDES permit. Testing and reporting of turbidity and ph will be required for a project determined to be Risk Level 2. Contractor's QSD/QSP will be required to prepare AdHoc reports of all testing on the State Water Resources Control Board's SMARTS database
- C. Cleaning: Keep area clean of debris.
- D. Remove all sediment control measures following site stabilization.
- E. The Contractor's QSD and QSP will be responsible for preparing and gaining approval of the annual report(s) and Notice of Termination on the State Water Resources Control Board's SMARTS database following project completion.

END OF SECTION 01 57 13

**SECTION 01 57 15
INTEGRATED PEST MANAGEMENT**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
1. Indoor populations of rodents, insects (including termites), arachnids, and arthropods.
 2. Outdoor populations of potentially indoor-infesting species within property boundaries.
 3. Nests of stinging insects within 20 feet of the building and within the property boundaries.
 4. Pest populations that are incidental invaders inside the building, including but not limited to:
 - a. Birds, bats, snakes, and vertebrates other than commensal rodents.
 - b. Pests that primarily feed on outdoor vegetation.
 5. Initial building and site inspection.
 6. Development of an Integrated Pest Management (IPM) Plan for building, site, and local ecosystems.
 7. Implementation of IPM Plan.
 8. Documentation of IPM services.

1.3 DEFINITIONS

- A. Definitions: Defined in ASTM E2114.
- B. Action Threshold:
1. The level at which action is initiated determined by an acceptable threshold of pests that can be tolerated:
 - a. The action threshold reflects the pest management objective for the site. The presence of some pests does not necessarily require action. When pest populations exceed established action thresholds, action is taken.
- C. Biological Control: The use of living organisms such as parasites, predators, or pathogens to maintain pest populations.
- D. Cultural Control: The manipulations of site ecosystem that make it less friendly to the establishment and proliferation of pest populations.
- E. Exclusion: The practice of structural and procedural modifications to reduce access used by pests.
- F. Integrated Pest Management (IPM): An approach to pest management that uses current, comprehensive information on the life cycles of pests and interactions with the environment to identify and implement effective methods of pest control with the least possible hazard to people, property, and the environment.
- G. Mechanical Control: The use of one or more physical components of the environment, such as temperature, humidity, or light, to the detriment of the pest.

- H. Phenology: The annual cycles of plants and animals and their response to seasonal changes in the environment.

1.4 SUBMITTALS

- A. Integrated Pest Management (IPM) Plan:
1. Minimum ten (10) days prior to pre-construction meeting, submit an IPM Plan including, but not limited to, the following:
 - a. Verify key pests and action thresholds for each key pest appropriate to Project, local ecosystem, and climate.
 - b. Proposed IPM strategies:
 - 1) For each key pest, submit an appropriate strategy for the building, site, and local ecosystems. Indicate strategies for inspection, prevention, and response to identified pest problems:
 - a) Inspection: Describe methods and procedures for identifying sites of pest harborage and access, and for objective assessments of pest population levels throughout the term of the Contract.
 - b) Prevention: Describe recommended methods and procedures for prevention of pest harborage and access.
 - c) Response: Indicate prioritization of strategies including utilization of nonchemical controls and lesser risk options before resorting to chemical control and actions with greater risk factors.
 2. For proposed materials and equipment, provide brand names of pesticide application equipment, rodent bait boxes, insect and rodent trapping devices, pest monitoring devices, pest detection equipment, and pest control devices or equipment that may be used to provide service:
 - a. Commercial Pesticide Applicator certificates or licenses: Submit photocopies of Commercial Pesticide Applicator certificates or licenses issued by the State of California for each applicator performing onsite services.
 - b. Pesticides:
 - 1) Submit:
 - a) Product data indicating conformance to U.S. National Organics Program (NOP) Final Rule list.
 - b) Current EPA registered label.
 - c) Material Safety Data Sheet (MSDS). Current prepared MSDS (updated within the previous five [5] years) including responses to Sections 1 through 16 in accordance with ANSI Z400.1:
 - a) Section 11: Toxicological Information. Include data used to determine the hazards cited in Section 3. Identify acute data, carcinogenicity, reproductive effects, and target organ effects.
 - b) Section 12: Ecological Information. Include data regarding environmental impacts in the event of an accidental release.
 - c) Section 13: Disposal Considerations. Include data regarding the proper disposal of the chemical. Indicate whether or not the product is considered to be "hazardous waste" according to the US EPA Hazardous Waste Regulations 40 CFR 261.
 - d) Section 14: Transportation Information. Identify hazard class for shipping.
 - e) Section 15: Regulatory Information. Identify federal, state, and local regulations applicable to the material.
 3. Service schedule:
 - a. Submit service schedule that includes weekly or monthly frequency of applications, specific day(s) of the week, and approximate duration of each application:
 - 1) Commencement of service: Start of construction.
 4. Revise and resubmit Plan as required by Owner. Approval of IPM Plan does not relieve Contractor of responsibility for compliance with applicable environmental regulations.

- B. Baseline IPM Reports:
 - 1. Prior to commencement of IPM Plan, submit the following:
 - a. Initial building inspection report: Conduct site visit to verify the pest control needs of each location and identify problem areas and necessary equipment, structural features, or management practices that contribute to pest infestations. Submit report summarizing observations. Indicate proposed revisions, if any, to approved IPM Plan necessary based upon results of the initial building inspection.
 - a. Summary of conventional pest management controls for key pests: Submit summary of conventional pest management materials and methods applicable to site and building for key pests. Include each type of pesticide, application rates, estimated annual quantity required, and environmental issues of concern.
- C. Operations and Maintenance Manual:
 - 1. Submit instructions for operations and maintenance procedures associated with IPM services:
 - a. Include overview of potential pest problems, conventional practices and environmental impacts, and IPM practices and environmental impacts.
 - b. Coordinate with landscaping maintenance program.
 - c. Coordinate with building cleaning and routine maintenance programs.
- D. Field Quality Control Documentation:
 - 1. Submit the following:
 - a. IPM inspection reports.
 - b. IPM deficiency reports.
 - c. IPM log book.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Provide pesticides registered with U.S. Environmental Protection Agency (EPA) and acceptable to local jurisdictions.
- B. Pest Controller Qualifications:
 - 1. Firm having a minimum of five (5) years of documented experience in performing pest control services, specifying who is certified as Commercial Pesticide Applicators in the category of Industrial, Institutional, Structural, and Health Related Pest Control, and who employs Certified Pesticide Applicators. Uncertified applicators working under the supervision of a Certified Applicator are not permitted to provide services.
 - 2. IPM Star certification:
 - a. IPM Star Service Provider in accordance with the IPM Institute of North America's certification program.
- C. Prohibited Pesticides:
 - 1. Do not apply pesticides that are not included in the approved IPM Plan or approved in writing by Owner:
 - a. Notification: Notify Owner a minimum of 72 hours prior to application of pesticides. Exceptions may be made for applications made for emergencies, where an imminent threat to health exists (i.e., stinging insects). For emergency applications, make notification as soon as practical.
- D. Pre-construction Meeting: Conduct meeting with Owner, Architect, and subcontractors to discuss the proposed IPM Plan and to develop mutual understanding relative to details of environmental protection.
- E. Coordination:
 - 1. Coordinate with Indoor Air Quality (IAQ) Management Plan to verify moisture controls

- are appropriate to IPM Plan.
2. Coordinate with Waste Management Plan to verify sanitation levels are appropriate to anticipated IPM Plan.
 3. Coordinate with progress cleaning methods verifying sanitation levels are appropriate to anticipated IPM Plan.

1.6 PERFORMANCE REQUIREMENTS

A. Key Pests and Action Thresholds:

Key Pest	Action Threshold	
	Interior	Exterior
Birds	1 bird	1 nest on building
Rats, Rodents, Opossum, similar	Any evidence of presence within building envelope	Any evidence of rats
Flies	1 complaint (when one or more become a nuisance)	1 complaint (when one or more become a nuisance); 30 per day based on monitoring count
Ants	1 complaint	1 fire ant mound within 100 feet of building/pavement
Cockroaches	1 cockroach in public areas or fresh food areas	n/a
Pantry Pests (meal moth)	1 complaint	n/a
Crickets	1 complaint	n/a
Weeds	n/a	tbd

B. Minimization of Risk:

1. Employ the pesticide with least risk, most precise application technique, and minimum quantity of pesticide necessary to achieve control:
 - a. Application of pesticides in an exterior or interior area shall not occur until a visual inspection is performed or monitoring devices indicate the presence of pests in that area.
 - b. Owner will evaluate recommendations for preventive pesticide treatments where inspection indicates a potential insect or rodent infestation on a case-by-case basis. Owner will approve preventative pesticide application in writing prior to treatment.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store pesticides onsite.
- B. Transport, handle, and use pesticides in strict accordance with the manufacturer's label instructions and applicable laws and regulations.

PART 2 GENERAL

2.1 CHEMICAL CONTROLS

- A. Prohibited Pesticides:
 1. Pesticides containing active ingredients classified as known, likely or probable

carcinogens or reproductive toxins according to any of the following lists: State of California EPA List of Chemicals Known to Cause Cancer or Reproductive Toxicity, State of Illinois EPA List of Known Endocrine Disrupters, US EPA List of Chemicals Evaluated for Carcinogenic Potential.

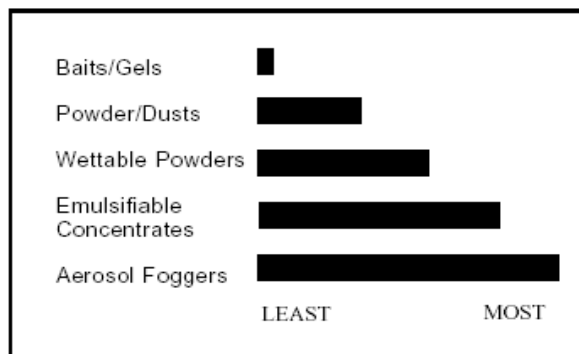
2. Pesticides containing inert ingredients included on US EPA's List 1: Inerts of Toxicological Concern.
3. Pesticide formulations and uses presenting a potential physical hazard or dust/powder inhalation hazard to building occupants.
4. Pesticides with label precautionary statements including "toxic" or "extremely toxic" to bees, birds, fish or wildlife. *Does not apply to pesticides used as per label directions to control bird, fish, wildlife or stinging insect pests.*
5. Pesticides with label precautionary statements including specific warnings regarding ground or surface water contamination.

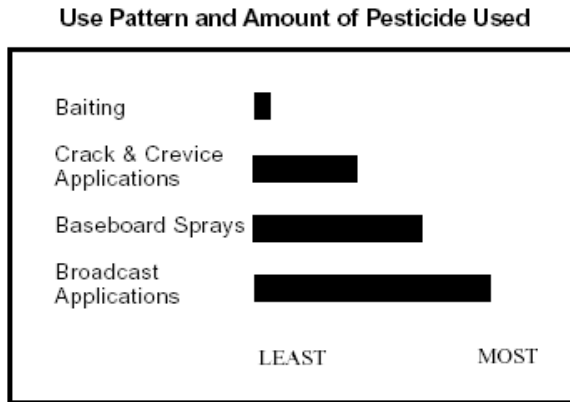
B. Lesser Risk Pesticides:

1. Materials listed on the U.S. National Organic Program's Final Rule, US Code of Federal Regulations 7CFR 205 list of acceptable materials and as follows:
 - a. Crawling insects - Boric acid-based or plant-based pesticides:
 - 1) Botanical pesticides: Pyrethrum, neem formulations, rotenone, and others as approved by Owner.
 - b. Rodents - Vitamin D3 (Cholecalciferol) or Quintox.
 - c. Weeds - Plant based pesticides and herbicides. Coordinate with Section 32 90 00: Landscape Planting:
 - 1) Botanical pesticides: Pyrethrum, neem formulations, rotenone, and others as approved by Owner.
 - d. Plant diseases - Plant based fertilizers. Coordinate with Section 32 90 00: Landscape Planting:
 - 1) Compost teas: Verify that compost tea does not include invasive species, including seeds. Verify that compost tea does not include animal pathogens.

C. Lesser Risk Pesticide Application Methodologies:

Likelihood the Pesticide Will Become Airborne





PART 3 GENERAL

3.1 NON-CHEMICAL PEST MANAGEMENT

- A. Provide IPM in accordance with approved IPM Plan and as follows:
1. Cultural controls:
 - a. Sanitation and exclusion: Recommend structural and procedural modifications as appropriate to reduce food, water, harborage, and access used by pests.
 - b. Soils: Maintain healthy, biologically active soils. Coordinate with Section 32 90 00: Landscape Planting.
 - c. Habitat for beneficial organisms: Recommend modifications as appropriate to promote healthy habitat for beneficial organisms. Habitat enhancement may include flowering annual or perennial plants that provide pollen and nectar needed during certain parts of the insect life cycle, overwintering sites, and wind protection. Coordinate with Section 32 90 00: Landscape Planting.
 - d. Phenology: Determine correlation with insect emergence and pest control. Develop recommendations as appropriate.
 2. Mechanical controls:
 - a. Traps:
 - 1) Rodents: Trapping devices shall be the standard method for indoor rodent control. All such devices shall be concealed out of the general view and in protected areas so as not to be affected by routine cleaning and other operations.
 - 2) Insects: Trapping devices shall be the standard method for indoor fly control.
 - b. Vacuums:
 - 1) Insects: Portable vacuums shall be the standard method for initial cleanouts of cockroach infestations, ants, termites, and for control of spiders in webs.
 - c. Flame weeding: Unless otherwise approved by Owner, flame weeding shall not be permitted.
 - d. Mulches, living or non-living:
 - 1) Weeds: Mulch shall be used for suppression of weeds, insect pests, and plant diseases as appropriate. Coordinate with Section 32 90 00: Landscape Planting.
 - e. Boiling water:
 - 1) Fire Ants (exterior): Boiling water shall be the standard method for control of exterior fire ants. Use boiling water at a rate of approximately three (3) gallons per mound.
 3. Biological controls:
 - a. Lady bugs, nematodes, and other biological controls: Permitted only for control of exterior ants, aphids, and/or other insects as appropriate. Coordinate with Section 32 90 00: Landscape Planting.

- b. Bats: Permitted only for control of exterior insects as appropriate.

3.2 CHEMICAL PEST MANAGEMENT

- A. Chemical Controls: Unless otherwise approved by Owner, Contractor shall use non-chemical methods of control. When pesticide use is necessary, Contractor shall employ the least risk, NOP-listed pesticide, most precise application technique, and minimum quantity of pesticide necessary to achieve control.
- B. Bait Boxes:
 - 1. Bait boxes shall be maintained with an emphasis on the safety of non-target organisms:
 - a. Bait boxes shall be placed out of the general view, in locations where they will not be disturbed by routine operations.
 - b. Lids shall be securely locked or fastened shut.
 - c. Bait boxes shall be securely attached or anchored to floor, ground, wall, or another immovable surface, so that the box cannot be picked up or moved.
 - d. Bait shall be secured in the feeding chamber of the box and never placed in the runway or entryways of the box.
 - e. Bait boxes shall be labeled on the inside with Contractor's business name and address and dated by Contractor's technician at the time of installation and each servicing.

3.3 PEST REMOVAL

- A. Pest Removal: Remove traps, bait boxes, and their contents according to the approved IPM Plan and as requested by Owner.

3.4 SPECIAL REQUESTS AND EMERGENCY SERVICE

- A. On occasion, Owner may request that Contractor perform corrective, special, or emergency service(s) that are beyond routine service requests. Contractor shall respond to these exceptional circumstances and complete the necessary work within three (3) hours after receipt of the request.

3.5 FIELD QUALITY CONTROL

- A. Inspection:
 - 1. Inspect building and site for pests and beneficials to gather information about the health of the landscaping and local ecosystem, pests, and natural enemies:
 - a. Methods:
 - 1) Use methods indicated in approved IPM Plan and as follows:
 - a) Sweep nets, sticky traps, and pheromone traps may be used to collect insects for both identification and population density information.
 - b) Leaf counts may be used for recording plant growth stages.
 - c) Square foot or larger grids laid out in a field may provide a basis for comparative weed counts.
 - d) Records of rainfall and temperature may be used to help predict the likelihood of disease infections.
 - b. Schedule: Inspect at regular intervals and at critical times in accordance with approved IPM Plan.
 - c. Reports: Document results of inspections. Submit using [GSA Form 3638, Pest Control Work and Inspection Report.] [form approved by Owner.]
- B. Recommendations:

1. Throughout the term of this Contract, Contractor shall be responsible for advising Owner about any structural, sanitary, or procedural modifications that would reduce pest food, water, harborage, or access:
 - a. Contractor shall be responsible for adequately suppressing all pests included in this Contract regardless of whether or not the suggested modifications are implemented.
 - b. Contractor will not be held responsible for carrying out structural modifications as part of the pest control effort; however, minor applications of caulk and other sealing materials by Contractor to eliminate pest harborage or access may be approved by Owner on a case by case basis. Contractor shall obtain the approval of Owner prior to application of sealing material and other structural modification.
- C. Log Book:
 1. Maintain a pest control logbook or file at the site. For each visit of the applicator, record:
 - a. IPM Plan: A copy of the approved IPM Plan.
 - b. IPM contact list: Include contact information for Contractor and Owner contact. Indicate emergency contact information for Contractor.
 - c. Schedule: Contractor's service schedule for the property. Identify IPM activity that has been performed.
 - d. Product data: A list of all pesticides used on property and product data for each as follows:
 - 1) Product data indicating conformance to U.S. National Organics Program (NOP) Final Rule list.
 - 2) Current EPA-registered label.
 - 3) Material Safety Data Sheet.
 - e. IPM inspection reports and deficiency reports.
 - f. Pest diagrams: Plans and site drawings noting the location of pest activity, including the location of all traps, trapping devices, and bait stations in or around the site.

END OF SECTION 01 57 15

SECTION 01 57 23 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Provide all material, labor, and services necessary to: comply with the State of California Construction General Permit Order 2022-0057-DWQ (CGP); implement the Project Storm Water Pollution Prevention Plan (SWPPP); and install and maintain appropriate Best Management Practices (BMP) according to the SWPPP and California Stormwater Quality Association (CASQA) Construction BMP Handbook.
 2. Retain a certified Qualified SWPPP Practitioner (QSP) to implement all Construction Site Monitoring Program (CSMP) elements of the SWPPP, or delegate appropriate roles to the trained Contractor.
 3. Complete and maintain all inspections, sampling, weather monitoring, and recordkeeping required by the CGP, commensurate with a Risk Level 1 SWPPP.
 4. Ensure that all conditions are met for SWPPP termination including, but not limited to: fully stabilizing all disturbed areas of the site; removing temporary BMPs, construction materials, and equipment; cleaning the site of any storm water pollutants within 90-days of completing outdoor construction activities; and notifying Owner and QSD of acceptable termination conditions.
 5. All Contract requirements in Division 00 and 01 specifications.
- B. This Section does not include:
1. The Owner shall retain a Qualified SWPPP Developer (QSD) to prepare the SWPPP document.
 2. The Owner shall submit the Notice of Intent (NOI), SWPPP, Changes of Information (COI), and Annual Reports, Notice of Termination (NOT) to the SWRCB on SMARTS.
 3. The Owner shall complete all required QSD inspections.
 4. The Owner shall pay the NOI application fee and annual renewal fees.
 5. The Owner shall maintain the role of LRP and all responsibilities associated, except where those responsibilities are assigned to the Contractor within these specifications.
 6. The Owner shall complete online digital certification of online reporting on SMARTS
 7. After the Contractor has met all conditions for SWPPP termination, Owner shall complete the NOT and obtain approval from SWRCB. If the NOT is returned by SWRCB due to unacceptable site conditions, Contractor shall implement any redresses specified by the SWRCB.
 8. Owner shall ensure that the Project design has incorporated all post-construction requirements specified by the CGP, MS4 permittee, and local agency stormwater regulations.
- C. Acronyms:
1. BMP Best Management Practices
 2. CGP Construction General Permit
 3. CSMP Construction Site Monitoring Program
 4. CASQA California Stormwater Quality Association
 5. EPA Environmental Protection Agency
 6. ELAP Environmental Laboratory Accreditation Program
 7. NOI Notice of Intent
 8. NOT Notice of Termination
 9. COI Change of Information

10.	MS4	Municipal Separate Storm Sewer System
11.	NPDES	National Pollution Discharge Elimination System
12.	QSD	Qualified SWPPP Developer
13.	QSP	Qualified SWPPP Practitioner
14.	LRP	Legally Responsible Person
15.	PRD	Permit Registration Documents
16.	COM	City of Madera
17.	SMARTS	Stormwater Multiple Application and Report Tracking System
18.	SWPPP	Storm Water Pollution Prevention Plan
19.	SWRCB	State Water Resources Control Board
20.	RWQCB	Regional Water Quality Control Board

1.2 REFERENCES

- A. Construction General Permit:
 - 1. 2022-0057-DWQ Construction General Permit
 - 2. https://www.waterboards.ca.gov/water_issues/programs/stormwater/construction/general_permit_reissuance.html
- B. Project SWPPP Document
 - 1. Available on SMARTS once approved by SWRCB
 - 2. Available by request from the Owner.
- C. CASQA Construction BMP Handbook:
 - 1. <https://www.casqa.org/resources/bmp-handbooks>
 - 2. Appendix G of the Project SWPPP.

1.3 RELATED SECTIONS

- A. Section 31 11 00 – Site Clearing
- B. Section 31 20 00 – Earthwork
- C. Section 33 40 00 – Storm Drainage
- D. Section 01 57 00 – Fugitive Dust Control

1.4 SUBMITTALS

- A. All submittals shall be in accordance with the submittal requirements of these specifications.
- B. The Contractor shall provide, to the Owner and QSD, the name, certification number, and contact information of their retained QSP within 30 days of starting construction.
- C. The Contractor shall provide to the Owner and QSD, completed training records of QSP delegation to the Contractor within 30 days of starting construction.
- D. The Contractor shall submit to the Owner and QSD the proposed product to be used at the site as soil binder or tackifier for the purposes of erosion control for approval.
- E. The Contractor, QSP, or QSP Delegates shall submit to the Owner and QSD analytical laboratory results from stormwater sampling to the Owner and QSD within 48 hours of receiving analytical results from the laboratory.

- F. The Contractor, QSP, or QSP Delegates shall submit to the Owner and QSD the dewatering field sampling results in the form of the Effluent Sampling Field Log within five days of an NAL exceedance for pH or turbidity.
- G. The Contractor shall provide, to Owner and QSD, documentation of implementing all SWPPP requirements, for each Annual Report, within 30 calendar days of the end of each reporting period (reporting period is July 1 through June 30 of each year), or upon requesting to terminate the Project SWPPP.
- H. Upon request from the Owner or Owner's agents, Contractor shall provide all documentation that is required throughout construction including, but not limited to, CSMP records, sampling records, non-stormwater spill and discharge events, rain logs, QSP-signed inspection reports for delegated reports, and completed QSP delegation training records.

1.5 REQUIREMENTS

- A. General:
 - 1. Contractor is responsible for understanding and carrying out all provisions of the SWPPP, CGP, and any requirements from local agencies (except as excluded above in 1.1.B., where Owner responsibilities are specified).
 - 2. The requirements of the CGP, SWPPP, MS4 permittee, and any other local regulations related to stormwater pollution prevention shall be reviewed by Contractor, prior to initiating any ground disturbance or other activities that could lead to stormwater pollution, for a full understanding of the intent, objectives, and implementation.
 - 3. Contractor responsibilities begin immediately upon execution of the contract containing these specifications and continue until the SWPPP has been terminated with SWRCB.
 - 4. Specific requirements include, but are not limited to:
 - a. Daily weather monitoring and record keeping to identify upcoming storm events and required qualifying precipitation event-related inspections.
 - b. Installation of an on-site rain gauge and daily rain gauge reading recording.
 - c. Installation, implementation, and maintenance of BMPs, and prevention of prohibited activities and unauthorized non-stormwater discharges.
 - d. Conducting and reporting to the QSD all non-visible pollutant release sampling and dewatering sampling.
 - e. Ensure that all subcontractors and agents are trained to understand and implement their relevant responsibilities under the CGP, SWPPP, and these specifications.
 - f. Pay any penalties, fines, and corrective action costs resulting from failure to comply with SWPPP, CGP, and local agency requirements, and hold the Owner/LRP harmless from any such failures.
 - g. Ensure that all conditions are met for SWPPP termination including, but not limited to: fully stabilizing all disturbed areas of the site; removing temporary BMPs, construction materials, and equipment; cleaning the site of any storm water pollutants; and notifying Owner and QSD of acceptable termination conditions.
 - 5. The SWPPP is an aid to the Contractor in complying with the CGP. CGP requirements shall take precedence over anything contained in the SWPPP, Contractor shall notify the Owner and QSD of any conflicts between the SWPPP and CGP, and no such conflicts shall relieve the Contractor of any responsibilities for execution of these specifications.
 - 6. See the approved SWPPP for the determined Project risk level. The requirements

associated with the project's risk level shall be found in the SWPPP.

- B. Retaining a Qualified SWPPP Practitioner (QSP)
 - 1. The Contractor shall retain a certified QSP who will have responsibility and oversight for the implementation of the CSMP elements of the SWPPP and CGP.
 - 2. Contractor shall maintain documentation in the on-site SWPPP and digitally that proves a certified QSP conducted oversight of all SWPPP and CGP compliance activities including, but not limited to:
 - a. CSMP inspections, training, weather forecast monitoring and recordkeeping, on-site rain gauge records, non-visible pollutant discharge sampling, and recordkeeping. The responsibilities of the Contractor's QSP are explained in Part 3, Section 3.1 of these SWPPP specifications.
- C. Non-visible pollutant discharge sampling:
 - 1. The Contractor's QSP shall train Contractor staff members on non-visible pollutant observation and sampling procedures of the CGP and Section 7 of the Project SWPPP. The QSP and QSP trained delegates shall conduct non-visible sampling when required by site observations and activities according to the CGP.
 - 2. The Contractor shall be prepared with a pH field meter and calibration fluid and clean non-visible pollutant sample bottles and preservatives based on the current non-visible pollutants on-site, as identified in Section 7 of the Project SWPPP.
 - 3. The Contractor shall be prepared to preserve stormwater samples on ice to 4° Celsius immediately after taking stormwater samples and until being driven, picked-up, or shipped to an ELAP certified laboratory.
 - 4. The Contractor shall pay for all costs related to non-visible pollutant sampling and laboratory analysis.
 - 5. A QSP-trained and delegated Contractor staff member or the QSP shall:
 - a. Always be available on-site within one hour during site operation hours to conduct non-visible pollutant discharge sampling as required by the CGP.
 - b. Complete the non-visible pollutant sampling procedures identified in Section 7 of the Project SWPPP and according to the CGP immediately after the discovery of exposure of non-visible pollutants to stormwater that have a potential to discharge off-site.
 - c. Take non-visible pollutant samples of effluent from waste dumpsters left uncovered during rainfall during site operation hours that have a potential to discharge off-site.
 - d. Take non-visible pollutant samples of runoff from demolished building materials left uncovered during rainfall during site operation hours that have a potential to discharge off-site.
 - 6. The Contractor or QSP shall report analytical laboratory results from stormwater sampling to the Owner and QSD within 48 hours of receiving analytical result from the laboratory.
- D. De-watering discharge sampling
 - 1. Prior to conducting dewatering operations via pump or siphon that could result in discharge off-site, the Contractor shall contact the QSP to ensure that dewatering discharge can be sampled for pH and turbidity in accordance with the Appendix J of the CGP and Section 7 of the Project SWPPP.
 - 2. The Contractor, QSP, or QSP trained delegates shall notify the Regional Water Quality Control Board via email 24-hours prior to the start of planned dewatering operations.
 - 3. The Contractor, QSP, or QSP Delegates shall notify the QSD and LRP if dewatering sample results yielded an NAL exceedance for pH or turbidity within 5 calendar days of the exceedance, including the completed Effluent Sampling Field Log.
 - 4. The Contractor shall immediately cease dewatering operations if dewatering

samples yield a result higher than 250 NTUs or is outside of the pH range for 6.5-8.5. The Contractor shall wait for sediment to settle/pH to neutralize or utilize BMPs to bring water for dewatering to be within the acceptable ranges of turbidity or pH when resuming dewatering operations.

- E. The Contractor shall be responsible for achieving Final Stabilization, as defined by the CGP, for all areas disturbed by Project construction activities in order to terminate the SWPPP within 90-days of completing construction activities, including areas without landscaping plans.
 - 1. The Contractor shall re-establish any existing vegetation disturbed by the Project with the same vegetation type as was disturbed.
 - 2. The Contractor shall achieve Final Stabilization for all graded areas with no landscaping plan and disturbed pre-existing non-landscaped vegetation disturbed by the Project with either non-vegetative stabilization as defined by the CASQA Construction BMP Handbook or by use of seeding/hydroseeding with a native erosion control seed mix.
- F. The Contractor shall be fully aware of the requirements for the full execution of the SWPPP; the requirements of these specifications for implementing, maintaining, and enforcing the provisions of the SWPPP; and the impact that the SWPPP will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost. Failure to comply with the CGP is a violation of federal and state law. Contractor hereby agrees to indemnify, defend and hold harmless Owner, its officers, agents, and employees from and against any and all claims, demands, losses or liabilities of any kind or nature which Owner, its officers, agents, and employees may sustain or incur for noncompliance with the Permit arising out of or in connection with the Project, except for liability resulting from the negligence or willful misconduct of Owner, its officers, agents or employees. Owner may seek damages from Contractor for delay in completing the Project in accordance herewith, including damage caused by Contractor's failure to comply with Permit requirements.

1.6 QUALITY ASSURANCE

- A. Certified SWPPP Professionals:
 - 1. Qualified SWPPP Developer (QSD)
 - a. The Owner shall retain a certified QSD.
 - b. The QSD's name, certification number, and contact information shall be listed within the SWPPP document.
 - 2. Qualified SWPPP Practitioner (QSP)
 - a. The Contractor shall retain a certified QSP.
 - b. The QSP's name, certification number, and contact information shall be provided to the Project QSD and in the on-site SWPPP.
- B. Regulatory Requirements:
 - 1. Contractor shall comply with the lawful requirements of any applicable municipality, county, drainage district, municipal storm water management program and other local agencies regarding discharges of storm water to separate storm drain system or other watercourses under their jurisdiction, including but not limited to the following:
 - a. EPA Environmental Protection Agency.
 - b. COM City of Madera

- c. SWRCB State Water Resources Control Board.
 - d. RWQCB Regional Water Quality Control Board.
- 2. All stormwater compliance shall be in accordance with local regulations:
 - a. City of Madera.
 - b. County of Madera.
 - c. Madera Irrigation District.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Best Management Practices (BMPs):
 - 1. The Contractor is responsible for the providing and furnishing all BMPs, products, and practices necessary to comply with the SWPPP and CGP. All materials and BMPs shall follow the CASQA Construction BMP Handbook and installed as described within the fact sheets, unless otherwise instructed by a qualified professional.
 - 2. The Contractor must provide, implement, and carry out all BMPs required to comply with the CGP, regardless of the BMPs contained in the SWPPP, and shall notify Owner and QSD of any conflicts between the SWPPP and CGP.
 - 3. The Contractor shall comply with the erosion control BMP requirements of the CGP, stating that BMPs must be initialized immediately to temporarily stabilize an area disturbed by construction where construction activities will not be resumed within 14 days (CGP Appendix D Section II.D.f).
 - 4. Prior to substantially altering BMPs recommended in the SWPPP, Contractor shall notify the Owner and QSD for review of the alternative BMPs and to obtain instructions for documenting the changes.
 - 5. Contractor shall consult with the QSP to ensure all BMPs are appropriate, feasible, effective, and correctly implemented.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Monitoring by the Contractor's QSP:
 - 1. Implement the CSMP and document all records in the SWPPP as required by the CGP, including, but not limited to: weekly, pre-storm, during-storm, post-storm, and quarterly inspections, daily weather monitoring, training of responsible contractor and subcontractor personell, and incidental non-visible pollutant discharge sampling.
 - a. CSMP inspection reports:
 - 1) The QSP or QSP trained delegates shall include photographs showing all disturbed areas, BMPs, BMP deficiencies, material storage locations, stormwater containment areas, and active construction areas. All photographs shall include comments noting any BMP corrective actions and completed corrective actions.
 - 2) The QSP or QSP trained delegates shall document in their CSMP Inspection reports when all outdoor construction activities have ceased.
 - b. QSP Training Records:
 - 1) The QSP or QSP trained delegates shall administer and document training of contractor and subcontractor staff responsible for BMP implementation, instillation, and maintenance and document it in the SWPPP.
 - 2) If QSP delegates any weekly/during storm inspections and/or non-visible pollutant discharge sampling requirements to Contractor personnel, QSP shall provide and document training to those personnel.
 - a) If CSMP inspection shave been delegated, the QSP shall review

- and sign all documentation completed by the trained QSP delegate.
- c. Weather Monitoring:
 - 1) The QSP or QSP trained delegates shall save records of daily weather monitoring of the nearest NOAA weather station.
 - 2) The QSP or QSP trained delegates shall record the daily on-site rain gauge reading and retain the records for the duration of the Project.
 - d. Incidental Non-Visible Pollutant Discharge Sampling:
 - 1) The QSP or QSP trained delegates shall perform any stormwater and non-stormwater sampling, as required by the CGP. If any samples are sent offsite for laboratory analysis, QSP will identify a designated ELAP-certified laboratory and coordinate sample procurement, transportation, analysis, and recordkeeping. If QSP delegates any of these duties to Contractor personnel, QSP shall provide training and document the training in the SWPPP. QSP shall upload sampling results to SMARTS.
 - e. De-watering Discharge Sampling
 - 1) Prior to conducting dewatering operations via pump or siphon that could result in discharge off-site, the Contractor shall contact the QSP to ensure that dewatering discharge can be sampled for pH and turbidity in accordance with the Appendix J of the CGP. The Contractor shall cease dewatering operations if dewatering samples yield a result higher than 250 NTUs or is outside of the pH range for 6.5-8.5. The Contractor shall wait for sediment to settle/pH to neutralize or utilize BMPs to bring water for dewatering to be within the acceptable ranges of turbidity or pH when resuming dewatering operations.
 - f. The QSP shall consult with the Contractor to understand the construction schedule and identify site areas where erosion control BMPs must be initialized immediately to temporarily stabilize an area disturbed by construction where construction activities will not be resumed within 14 days in accordance with CGP Appendix D Section II.D.f.
- 2. New CSMP records outlined above in Part 3, Section 3.1.A shall be provided by the QSP to the QSD and Owner on a bi-monthly basis while the SWPPP NOI is active. New CSMP records shall be sent in the first week of odd numbered months.
 - 3. The QSP shall identify required amendments to the SWPPP based on construction activity and notify the QSD and Owner.
 - 4. The QSP shall identify when the site area has achieved "final stabilization" per the CGP definition, and inform the QSD and Owner.
 - 5. The Contractor's QSP shall advise the Contractor on achieving final stabilization of all areas disturbed by the Project within 90-days of outdoor construction activities ceasing. The Contractor shall be responsible for achieving final stabilization, as defined by the CGP, for all areas disturbed by Project activities, including areas without landscaping plans.
 - 6. For the full monitoring requirements refer to the SWPPP and CGP.
- B. Monitoring by Owner
- 1. The Owner has the right to monitor and oversee the Contractor's implementation and maintenance of the BMPs and SWPPP.
 - 2. Should the Owner determine that the Contractor's efforts fail to meet the requirements of the CGP and the SWPPP, the Owner reserves the right to employ any and/or all of the following actions:
 - a. Notify the SWRCB of the perceived failure of the Contractor to comply with the CGP and SWPPP.
 - b. Withhold an amount of money from the Contractor's Payment Request, equal to the Owner's estimate of the value of the work required to implement and maintain the required BMPs, as well as provide the required inspection,

- training, and testing forms.
- c. If the SWPPP is not terminated within 90-days of outdoor construction activities ceasing, withhold monies due the Contractor under this Contract, in an amount sufficient to complete the work, pay any additional fees due the State, and close out the SWPPP in compliance with the General Permit.
- C. Availability and access to the SWPPP:
 - 1. As required by the SWPPP and CGP, the Contractor shall keep a minimum of one copy of the SWPPP, addenda, all PRDS, all inspection reports and all SWPPP records in the following locations:
 - a. Contractor's Project Site Field Office.
 - b. Contractor's General Business Office.
 - 2. The SWPPP shall be made available for public inspection at any time during normal business hours.
 - 3. All SWPPP records shall be made available to the Owner and their agents when requested.

3.2 CLEANING AND REMOVAL

- A. Removal of BMPs
 - 1. All temporary BMPs shall be completely removed from the Project Site prior to filing of the NOT.
 - 2. The removal of any and all BMPs shall be coordinated and approved by the Contractor's QSP.
 - 3. All permanent BMPs shall remain on the Project Site, unless directed otherwise by Owner. The Owner will be responsible for ongoing inspection and maintenance after final acceptance.
- B. Under written agreement and with the approval of the Owner, the Contractor may assign maintenance and removal responsibilities of the project BMPs to a subsequent Contractor for later work phases at the Project Site.

3.3 RECORD KEEPING

- A. Paper and electronic records of all CSMP inspections, testing, training reports, all PRDs, inspection records, site photos, and all other SWPPP related records, shall be retained for a period of at least three years after the close of construction. These records shall be available at the project site until construction is completed.

3.4 PAYMENT

- A. Full compensation for all costs involved in implementing, and monitoring the implementation of the SWPPP for this project, including inspections, testing, and training, performing corrective measures as required to better implement the SWPPP, providing all labor, materials, and resources to maintain the SWPPP and all required records of the SWPPP, and being full liable for all failures to fulfill the intent and requirements of the CGP set forth by the SWRCB, shall be included in the cost bid for the various items of work and no additional payment will be made therefor.

END OF SECTION 01 57 23

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 25 00 - Substitution Procedures for requests for substitutions.

1.02 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.03 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.05 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00 - Closeout Procedures.

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

- b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
- 4. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 - Substitution Procedures for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

**SECTION 01 64 00
OWNER FURNISHED CONTRACTOR INSTALLED**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for the following:
 - 1. Installing Owner-furnished materials and equipment.
 - 2. Providing necessary utilities, connections and rough-ins.

1.3 DEFINITIONS

- A. Owner: District, who is providing/furnishing materials and equipment.
- B. Installing Contractor: Contractor, who is installing the materials and equipment furnished by the Owner.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Receive, store and handle products in accordance with the manufacturer's instructions.
- B. Protect equipment items as required to prevent damage during storage and construction.

PART 2 PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

- A. Installing Contractor's Responsibilities:
 - 1. Verify mounting and utility requirements for Owner-furnished materials and equipment items.
 - 2. Provide mounting and utility rough in for all items where required:
 - a. Rough in locations, sizes, capacities, and similar type items shall be as indicated and required by product manufacturer.
- B. Owner and Installing Contractor(s) Responsibilities:
 - 1. Owner-Furnished/Contractor Installed (OFCl) - Furnished by the Owner; installed by the Installing Contractor:
 - a. General: Owner and Installing Contractor(s) will coordinate deliveries of materials and equipment to coincide with the construction schedule.
 - b. Owner will furnish specified materials and equipment delivered to the site. Owner/vendor's representative shall be present on Site at the time of delivery to comply with the contract requirements and Specifications Section 01 43 00: Materials and Equipment.
 - c. The Owner furnishing specified materials and equipment is responsible to provide manufacturer guarantees as required by the Contract to the Installing Contractor.
 - d. The Installing Contractor shall:
 - 1) Review, verify and accept the approved manufacturer's submittal/Shop

Drawings for all materials and equipment required to be installed by the Installer Contractor and furnished by the Owner. Any discrepancies, including but not limited to possible space conflicts, should be brought to the attention of the Project Manager and/or Program Manager, if applicable.

- 2) Coordinate timely delivery. Installing Contractor shall receive materials and equipment at Site when delivered and give written receipt at time of delivery, noting visible defects or omissions; if such declaration is not given, the Installing Contractor shall assume responsibility for such defects and omissions.
- 3) Store materials and equipment until ready for installation and protect from loss and damage. Installing Contractor is responsible for providing adequate storage space.
- 4) Coordinate with other bid package contractors and field measurement to ensure complete installation.
- 5) Uncrate, assemble, and set in place.
- 6) Provide adequate supports.
- 7) Install materials and equipment in accordance with manufacturer's recommendations, instructions, and Shop Drawings, supply labor and material required, and make mechanical, plumbing, and electrical connections required to operate equipment.
- 8) Be certified by equipment manufacturer for installation of the specific equipment supplied by the Owner.
- 9) Provide anchorage and/or bracing as required for seismic restraint per Title 24, UBC Standard 27-11 and all other applicable codes.
- 10) Provide the contract-required warranty and guarantee for all work, materials and equipment, and installation upon its completion and acceptance by the District. Guarantee includes all costs associated with the removal, shipping to and from the Site, and re-installation of any equipment found to be defective.

- C. Compatibility with Space and Service Requirements:
1. Equipment items shall be compatible with space limitations indicated and as shown on the Contract Documents and specified in other sections of the Specifications.
 2. Modifications to equipment items required to conform to space limitations specified for rough in shall not cause additional cost to the District.
- D. Manufacturer's printed descriptions, specifications, and instructions shall govern the Work unless specifically indicated or specified otherwise.

2.2 FURNISHED MATERIALS AND EQUIPMENT

- A. All furnished materials and equipment are indicated or scheduled on the Contract Documents.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment items in accordance with the manufacturer's instructions.
- B. Set equipment items securely in place, rigidly or flexibly mounted in accordance with manufacturers' directions.
- C. Make electrical and mechanical connections as indicated and required.

- D. Touch-up and restore damaged or defaced finishes to the Owner's satisfaction.

3.2 CLEANING AND PROTECTION

- A. Repair or replace items not acceptable to the Architect or Owner.
- B. Upon completion of installation, clean equipment items in accordance with manufacturer's recommendations, and protect from damage until final acceptance of the Work by the Owner.

END OF SECTION 01 64 00

SECTION 01 73 00 EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Coordination of Owner-installed products.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor or professional Engineer certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two (2) copies signed by land surveyor.
- D. Final Property Survey: Submit ten (10) copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor legally qualified to practice in the State of California, who is experienced in providing land surveying services of the kind indicated.
- B. Manufacturer's Installation Instructions: Obtain and maintain onsite manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials:
 - 1. Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible:
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Existing Conditions:
 - 1. The existence and location of underground and other utilities and construction indicated as existing are not warranted. Before beginning site Work, investigate and verify existence and location of underground utilities, mechanical and electrical systems, and construction affecting the Work:
 - a. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping, underground electrical services, and other utilities.
 - b. Furnish location data for work related to the Work that must be performed by public utilities serving the site.
- B. Examination and Acceptance of Conditions:
 - 1. Before proceeding with each component of the Work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations:
 - a. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - b. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - c. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report:
 - 1. Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
- D. Proceed with installation after correcting unsatisfactory conditions. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00: Project Management and Coordination.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor or professional Engineer to lay out the Work using accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as necessary to locate each element of Project.
 - 2. Establish limits on use of site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level, and plumb of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two (2) or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points:
 - 1. Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control

points during construction operations:

- a. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - b. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks:
1. Establish and maintain a minimum of two (2) permanent benchmarks on site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark:
 - a. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - b. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - c. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey:
1. Engage a land surveyor or professional Engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional Engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey:
 - a. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - b. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated:
 1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches (2,440 mm) in occupied spaces and 90 inches (2,300 mm) in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions ensuring the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items onsite and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check shop drawings of other Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment:
 - 1. Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions:
 - a. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - b. Allow for building movement, including thermal expansion and contraction.
 - c. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous. Materials containing asbestos and BCPs are prohibited.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to site for Owner's construction personnel.
- B. Coordination:
 - 1. Coordinate construction and operations of the Work with Work performed by Owner's construction personnel:
 - a. Construction schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - b. Pre-installation conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's Work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

- A. Clean site and Work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully:
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 degrees F (27 degrees C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 4. Use containers intended for holding waste materials of type to be stored.
 5. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain site free of waste materials and debris.
- C. Work Areas:
1. Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work:
 - a. Remove liquid spills promptly.
 - b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire Work area, as appropriate.
- D. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials onsite. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in **Section 01 50 00: Temporary Facilities and Controls**.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with mechanical, plumbing, and electrical requirements.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and

safeties. Replace damaged and malfunctioning controls and equipment.

- E. Manufacturer's Field Service: Comply with qualification requirements in **Section 01 40 00: Quality Requirements.**

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes procedural requirements for cutting and patching.

1.3 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other work.

1.4 SUBMITTALS

- A. Cutting and Patching Plan:
 - 1. Submit plan describing procedures at least ten (10) days prior to the time cutting and patching will be performed. Include the following information:
 - a. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - b. Changes to in-place construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - c. Products: List products used for patching and firms or entities that will perform patching work.
 - d. Dates: Indicate when cutting and patching will be performed.
 - e. Utilities and mechanical and electrical systems:
 - 1) List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted:
 - a) Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
- B. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- C. Operational Elements:

1. Do not cut and patch operating elements and related components that results in reducing the capacity to perform as intended or that results in increased maintenance or decreased operational life or safety:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire suppression systems.
 - e. Mechanical systems' piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire detection and alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
- D. Miscellaneous Elements:
 1. Do not cut and patch the following elements or related components that change the load bearing capacity, resulting in a reduction of capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain wall construction.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise and vibration control elements and systems.
 - g. Sprayed fire resistive material.
- E. Visual Requirements:
 1. Do not cut and patch construction resulting in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner:
 - a. If possible, retain original installer or fabricator to cut and patch exposed Work. If possible, engage original installer or fabricator. If original installer is not available, engage recognized, experienced, and specialized firm for the Work:
 - 1) Processed concrete finishes.
 - 2) Ornamental metal.
 - 3) Matched veneer woodwork.
 - 4) Preformed metal panels.
 - 5) Roofing.
 - 6) Firestopping.
 - 7) Window system.
 - 8) Fluid applied flooring.
 - 9) Wall covering.
 - 10) HVAC enclosures, cabinets, or covers.
- F. Cutting and Patching Conference: Before proceeding, meet at site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with

materials so as not to void existing warranties.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Comply with specified requirements.
- B. Existing Materials:
 - 1. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible:
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed:
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where removal, relocation, or abandonment is necessary, bypass existing services before cutting to avoid interruption of services to occupied areas.

3.3 CUTTING AND PATCHING

- A. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time, and complete without delay:
 - 1. Cut existing construction to provide for installation of components or performance of construction, and subsequently patch as necessary to restore surfaces to an original condition.
 - 2. Cut in place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Temporary Support: Provide temporary support of Work to be cut.
- C. Protection: Protect in place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be

exposed during cutting and patching operations.

- D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00: Summary and what is shown on Drawings.
- E. Cutting:
1. Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer; comply with original installer's written recommendations:
 - a. Use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - b. Finished surfaces: Cut or drill from exposed or finished side into concealed surfaces.
 - c. Concrete and masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - d. Excavating and backfilling: Comply with requirements in applicable earthwork specifications by cutting and patching operations.
 - e. Mechanical and electrical services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - f. Proceed with patching after construction operations requiring cutting are complete.
- F. Patching:
1. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications:
 - a. Inspection:
 - 1) Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - b. Exposed finishes:
 - 1) Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction to eliminate evidence of patching and refinishing:
 - a) Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b) Restore damaged pipe covering to its original condition.
 2. Floors and walls: Where walls or partitions are removed, extend one finished area into another, patch and repair surfaces in new space. Provide even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 3. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior building enclosure: Patch components and restore enclosure to a weathertight condition.

END OF SECTION 01 73 29

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Salvaging non-hazardous construction waste.
 - 2. Recycling non-hazardous construction waste.
 - 3. Disposing of non-hazardous construction waste.

1.02 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery demolition of construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 90 percent by weight (or by volume, but not a combination) of total waste generated by the Work.

1.04 SUBMITTALS

- A. Waste Management Plan: Submit 3 copies of plan within 30 days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include the following information:
 - 1. Material Category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons or cubic yards.
 - 4. Quantity of waste salvaged, either estimated and actual in tons or cubic yards.
 - 5. Quantity of waste recycled, either estimated and actual in tons or cubic yards.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons or cubic yards.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-project rates for salvage, recycling, and disposal as a percentage of total waste generated by the work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Record of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Qualification Date: For Waste Management Coordinator.
- I. State of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 74 19 – Construction Waste Management and Disposal review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review recycling rates of recycling facilities.
 - 6. Review waste management requirements for each trade.

1.06 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Includes names, addresses, and telephone numbers.

5. Disposed Materials: Indicate how and where materials will be disposed of. Include recycling rate, name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separation recyclable waste including sizes of containers, container labeling, and designated location on Project Site where materials separation will be located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Construction Manager. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the contract.
 1. Comply with Section 01 50 00 - Temporary Facilities and Controls for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Comply with Section 01 50 00 -Temporary Facilities and Controls.

3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.03 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and tress on-site.
- C. Wood Materials:
 - 1. Clean Cut-offs of lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinder.

3.04 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 74 23

CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Perform cleaning and disposal work as specified, complete. This Section forms a part of all other Sections of the specifications and shall be coordinated with such additional cleaning and disposal requirements as may be specified in other Sections.
- B. Related Requirements:
 - 1. Section 01 74 19 - Construction Waste Management.
 - 2. Pertinent Specification Sections: Specific requirements for cleaning.

1.02 CLEANING IN GENERAL

- A. Contractor shall at all times keep premises free from accumulations of waste material or rubbish caused by Contractor's employees or work, or employees or work of subcontractors, and shall remove rubbish from and about areas of Work and Contractor's and subcontractors' tools, scaffolding and surplus materials and shall leave the Work "broom clean", or its equivalent, except as hereinafter specified. In case of dispute between Contractor and other contractors employed on or about the work areas, as to responsibility for removal of rubbish, etc., or in case debris is not promptly removed as herein required, the State may remove rubbish, etc., and backcharge the Contractor.
- B. At all times, Project working area and site shall be kept clean and orderly. Dirt, debris, waste, rubbish and disused implements and equipment shall be removed frequently and not allowed to accumulate more than 24 hours. Flammable and toxic materials shall not be stored in structures>.

1.03 FINAL CLEANING

- A. Within Contract limits, 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.
 - 1. Clean equipment and fixtures to sanitary condition, clean or replace filters of mechanical equipment.
 - 2. Clean roofs, gutters, downspouts and drainage systems.
 - 3. Glass: Clean all glass, interior and exterior, affected by Work of this Project; including removal of foreign material from glass.
- B. Clean site: Sweep paved areas, rake clean other surfaces.

- C. Remove waste and surplus materials, rubbish and construction facilities from Project and from site.
- D. Dust, dirt, stains, hand marks, paint spots, and like defects shall be completely removed from surfaces. Metal surfaces shall be cleaned, using only non-corrosive and non-abrasive materials.
- E. Final Inspection: Deficient cleaning operations, as determined by the State, shall be immediately corrected as directed.

1.04 DISPOSAL

- A. Under no circumstances shall rubbish or waste material be disposed of in site fills or backfills. Debris, rubbish, and waste or surplus material shall be removed from the State property daily and legally disposed of.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 01 78 23 - Operation and Maintenance Data for operation and maintenance manual requirements.
 - 2. Section 01 78 39 - Project Record Documents for submitting record Drawings, record Specifications, and record Product Data.
 - 3. Section 01 79 00 - Demonstration and Training for requirements for instructing Owner's personnel.

1.02 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.03 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.05 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 - Demonstration and Training.
 - 6. Advise Owner of changeover in heat and other utilities.

7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 7 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.06 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 00 72 00-General Conditions.
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect and Engineers will either proceed with inspection or notify Contractor of unfulfilled requirements.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.07 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing

correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.08 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average

commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.

3.02 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

CLOSE-OUT FORM "A"

SUBCONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN

STATE OF CALIFORNIA

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the _____ of _____, the subcontractor who supplied, installed, and /or erected the Work described below, and that, he /she is duly authorized to make this Affidavit and Subcontractor Release:

Project: Madera High School Stadium

Owner: Madera Unified School District

Architect: PBK

Work Performed: _____ Specification Section(s): _____

2. That all Work required under the subject subcontractor of the subject construction project has been performed in accordance with the terms thereof, that all material men, sub-subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said subcontractor which have not been paid and satisfied in full.
3. That to the best of his / her knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said subcontract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.
4. That he / she has received full payment of all sums due him / her for materials furnished and services rendered by the undersigned in connection with the performance of said subcontract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said subcontract.

ATTEST (If Corporation)

Name of Subcontractor

Secretary

(By)

(Title)

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20____.

(Seal)

(Notary Public Signature)

CLOSE OUT FORM "B"

1. PROJECT INFORMATION

Facility:

Address:

City:

DISTRICT:

ARCHITECT/ENGINEER:

CONTRACTOR/CM:

CONTRACT DATE:

DATE DISTRICT AUTHORIZED PROJECT:

BRIEF DESCRIPTION OF PROJECT:

(This description should match the Summary with exceptions of all change orders and Directives)

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of California, Division of the State Architect Office and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the educational program and the educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT:

BY:

DATE:

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, June 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER:

BY:

DATE:

5. The Contractor/CM certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM:

BY:

DATE:

INSTRUCTIONS FOR CLOSE OUT FORM B:

Section 1. Identify the following:

- name and address of the school facility
- name of the school district
- the Architect/Engineer and Contractor
- the date of execution of the construction contract
- the date that the school district authorized the superintendent to hire an architect/engineer
- scope of the project.

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the DSA plan review for code compliance and returned to the school district's files.

Section 5. This section is to be executed by the contractor upon substantial completion of the project and retained in the school district's files. Included with this document a copy of the Certificate of Substantial Completion, found in the Project Manual.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project along with the original Certificate of Substantial Completion form..

Attachment copy of: "Substantial Completion form"

CLOSE-OUT FORM "C"

SUBCONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

THE STATE OF _____ PROJECT: Madera High School Stadium

COUNTY OF _____ OWNER: Madera Unified School District

ARCHITECT: PBK

SPECIFICATION SECTION(S):

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says that he / she
is the

_____ of _____, the subcontractor / supplier
who constructed or provided the section(s) of Work referenced above, and that he / she is duly authorized
to certify to the best of his / her information, knowledge, and belief no asbestos, lead or PCB containing
products have been incorporated into the project.

ATTEST (If Corporation)

Name of Subcontractor / Supplier

(Title)

Secretary (By)

JURAT

THE STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20____.

(Seal)

(Notary Public Signature)

CLOSE-OUT FORM "D"

SUBCONTRACTOR WARRANTY

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the Subcontractor (or the _____ of _____ the subcontractor) who supplied, installed, and / or erected the Work described below, and that, he / she is duly authorized to make this Subcontractor Warranty:

Project: Madera High School Stadium

Owner: Madera Unified School District

Architect: PBK

Work Performed: _____ Specification Section(s): _____

2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.
3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Subcontractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Architect.
4. The Subcontractor warrants the Work performed for a period of _____ months from the date of Substantial Completion, except as follows: _____

ATTEST (If Corporation)

Name of Subcontractor

Secretary

(By)

(Title)

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20____.

PBK Architects
Project No. 20-51

Madera High School Stadium
Madera Unified School District

(Seal)

(Notary Public Signature)

SECTION 01 77 01

GUARANTEE FORM

GUARANTEE FOR _____

DISTRICT: _____

PROJECT: _____

ADDRESS: _____

DATE OF PROJECT ACCEPTANCE: _____

We hereby guarantee the _____,
which we have installed in the above project, for a period of _____ year(s), in accordance with
the requirements of the specifications. We agree to repair or replace any or all such work,
together with any other work which may be displaced or marred in so doing, that may prove
defective in workmanship or materials within the above-mentioned period (from date of
acceptance) without expense whatsoever to the District, ordinary wear and tear and unusual
abuse or neglect excepted.

Signature of General Contractor

Signature of Subcontractor

Address

Address

Phone

Phone

Date

Date

END OF SECTION

SECTION 01 77 10
DSA PROJECT CLOSEOUT AND CERTIFICATION PROCESS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related Sections:
 - 1. Section 01 31 00: Project Management and Coordination.
 - 2. Section 01 32 10: Preconstruction Conference Notes
 - 3. Section 01 42 00: References.
 - 4. Section 01 73 00: Execution.
 - 5. **Section 01 77 00: Closeout Procedures** (Including forms A, B, C, and D)
 - 6. Section 01 77 22: Substantial Completion Procedures.

1.2 PRE-CONSTRUCTION

- A. DSA Documents Required:
 - 1. **SSS 103 Form** to provide DSA and General Contractor with a Structural Testing and Inspections list (T&I).
 - 2. **DSA Form 5** is to be filled out for District to select a Project Inspector (P.I.) to be hired for the particular project type (Class 1, 2 or 3) required. This Project Inspector must be interviewed and approved by the Architect of Record & Structural Engineer of Record. The Project Inspector and Special Testing Laboratory must be DSA Approved.
 - 3. **Pre-Construction Meeting** will be conducted by the Design Professional. Use standard PBK-WLC Pre-Con Sheet and customize for your project. Identify and discuss regulatory responsibilities of Design Professionals, Project Inspector, Testing Lab, General Contractor, the District and DSA.
 - 4. **Provide Documents** such as DSA Approved Plans & Specs, Soils Reports, Hazard Material Report, Addendums and any Material/Color Boards to the General Contractor and Project Inspector.
 - 5. **DSA Approvals.** The Design Professionals responsibility to obtain timely DSA Approval of all Addendums, Construction Change Directives and any changes to the approved Construction Documents. These changes can be a CCD "A" or a CCD "B" to be filled out on the DSA 140 Form. CCD "A" is work that effects changes to Structural Safety, Fire Life Safety or Access Compliance. CCD "B" is all other work that will make DSA aware of other important changes but do not affect Structural Safety, Fire Life Safety or Access Compliance. (Simple color of paint or floor finish, cabinet finishes for example are not to be submitted). Deferred Approvals by DSA will be the responsibility of the General Contractor.
 - 6. **Submit DSA Form 102** for Construction Start Notice and Inspection Card Request. This form will include Notice of Construction Start Date, information on the School District, Scope of Work, Listing of Project Participants (Design Professionals, Project Inspector, In-Plant Inspector if any, General Contractor, Laboratory of Record, Geotechnical Engineer, Project Delivery Method, Collaborators for DSA Box Type of Access granted).

1.3 CONSTRUCTION

- A. Project Review:
 - 1. **Project Inspector** shall provide continuous inspection during construction, provide

daily and semi-monthly reports of progress of the scope of work to the District, the Design Professionals and DSA. Participate in resolutions for questions from the contractor and report the status of DSA Field Trip Note issues. Provide a current written record of all work inspected and monitor testing and special inspections required. The Project Inspector will notify contractor of any defective work or deviation from the DSA Approved Plans. If this work is not corrected a Deviation Notice will be issued by the P.I. This can sometimes require the Design Professionals to issue a CCD to DSA for Approval of additional or amended construction documents.

2. **Design Professional** shall observe the construction, obtain deviations from the approved documents by means of COs, CCDs, RFIs, PCOs, ASIs, etc. Resolve DSA Field Trip Note issues.
3. **General Contractors** shall construct the project per the approved plans, timely corrections of Deviations noted by the Project Inspector or Design Professionals and timely submission of Deferred Approvals.
4. **Testing Laboratory** shall provide material testing and special inspections, submit all materials testing and special inspections reports to DSA, Design Professional, Structural Engineer, and Project Inspector.

1.4 CLOSE OUT & CERTIFICATION

A. Project Closeout:

1. Contractor shall notify the Design Professional & the District when they are completed enough to have a Punch Walk conducted. After the Punch List items have been completed the contractor shall notify the Design Professionals for issuance of a Notice of Substantial Completion that will start the warranty process for work completed.
2. **Certification is a letter** issued by DSA Certifying that the building project has been completed in accordance with requirements as to the safety and design of the Education Code sections 17280-17316 and 81130-81147. Without Certification the School Board has liability for an future damage to public safety and DSA will be unable to approve plans affecting uncertified construction at any time in the future.
3. **Closing document** should be obtained and submitted to DSA as soon as they become obtainable. Close out is initiated by the DSA Field Engineer. DSA will issue a 90 Day Letter requesting outstanding documents or unresolved issued that are required. All these need to be resolved prior to DSA issuing letter of certification.
4. **District responsibilities** include issuing Notice of Completion and submit fee to DSA invoices. DSA Form 168 for final cost of construction and submit to DSA.
5. **Design Professionals responsibilities** include resolving any outstanding issues related to the DSA 90 Day Letter, and submit a Verified Report DSA Form 6A/E.
6. **Contractors & Project Inspectors responsibilities** include submit Verified Report DSA Form 6.
7. **Laboratories responsibilities** include submit Lab Verified Report DSA Form 291, Special Inspection Verified Report DSA Form 292, and submit Geotechnical Verified Report DSA Form 293.

END OF SECTION 01 77 10

SECTION 01 77 22
SUBSTANTIAL COMPLETION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, Substantial Completion procedures.
- B. Related Sections:
 - 1. Section 01 77 00: Closeout Procedures.

1.3 SUBMITTALS

- A. Contractor's List of Incomplete Items (Punch List): Initial submittal at Substantial Completion.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion:
 - 1. Minimum of ten (10) days prior to requesting an inspection for determining date of Substantial Completion. List items that are incomplete at time of request:
 - a. Certificates of release: Obtain and submit releases from all (i.e. city, county, authorities) authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - b. Submit closeout submittals, including Project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - c. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - d. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable:
 - 1) List of extra materials: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - e. Submit test/adjust/balance records from Owner vendor.
 - f. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- C. Procedures Prior to Substantial Completion:
1. A minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion, submit list items that are incomplete at time of request:
 - a. Advise Owner of pending insurance changeover requirements.
 - b. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - c. Complete startup and testing of systems and equipment.
 - d. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - e. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings as applicable.
 - f. Advise Owner of changeover in heat and utilities.
 - g. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - h. Terminate and remove temporary facilities from site, including mockups, construction tools, and similar elements, and restore or configure area to required or original condition.
 - i. Complete final cleaning requirements, including touchup painting.
 - j. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 - k. Conditional lien regulations.
- D. Inspection:
1. Submit written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued:
 - a. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - b. Results of completed inspection will form the basis of requirements for final completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 FINAL CLEANING

- A. Perform Final Cleaning:
1. Conduct cleaning and waste-removal operations to comply with local laws and ordinances, and Federal and local environmental and antipollution regulations.
 2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions:
 - a. Complete cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project. Cleaning activities include but are not limited to:
 - 1) Clean site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - 2) Sweep paved areas broom clean. Remove petrochemical spills, stains, and

foreign deposits.

- 3) Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
- 4) Remove tools, construction equipment, machinery, and surplus material from Project site.
- 5) Remove snow and ice to provide safe access to building.
- 6) Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
- 7) Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- 8) Sweep concrete floors broom clean in unoccupied spaces.
- 9) Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- 10) Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- 11) Remove labels that are not permanent.
- 12) Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- 13) Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- 14) Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- 15) Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection:
 - a) Clean HVAC system in compliance with NADCA Standard ACR 2013. Provide written report on completion of cleaning.
- 16) Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- 17) Leave Project clean and ready for occupancy.

B. Pest Control:

1. Comply with pest control requirements in Section 01 57 15: Integrated Pest Management. Prepare written report.

C. Construction Waste Disposal:

1. Comply with waste disposal requirements.

END OF SECTION 01 77 22

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.02 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
 - 2. Two paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

PART 2 - PRODUCTS

2.01 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into

individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.02 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.

2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.03 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.

- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.04 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 01 77 00 - Closeout Procedures for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 01 78 23 - Operation and Maintenance Data for operation and maintenance manual requirements.

1.02 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Final Submittal:
 - 1) Submit 1 paper-copy set of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and 1 set of prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy of each submittal.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity

who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as paper copy.

2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders and record Drawings where applicable.
- B. Format: Submit record Product Data as paper copy.

2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as paper copy.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for

construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 01 78 43

SPARE PARTS AND MAINTENANCE MATERIALS

PART 1: GENERAL

1.01 REQUIREMENTS INCLUDED:

- A. Products required.
- B. Storage and delivery of products.

1.02 RELATED REQUIREMENTS:

- A. Section 01 78 23 - Operation and Maintenance Data.
- B. Individual Specification Sections: Specific spare parts and materials required.

1.03 PRODUCTS REQUIRED:

- A. Provide quantities of products, spare parts, maintenance tools, and maintenance materials specified in individual sections to be provided to District, in addition to that required for completion of Work.
- B. Products: Identical to those installed in the Work. Include quantities in original purchase from supplier or manufacturer to avoid variations in manufacture.

1.04 STORAGE, MAINTENANCE:

- A. After delivery of products to site, maintain spare products in same space and condition as products to be installed in the Work.
- B. Maintain spare products in original containers with labels intact and legible, until delivery to District.

1.05 DELIVERY:

- A. Coordinate with District: Deliver and unload spare products to District and obtain receipt prior to final payment.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.02 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.03 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 - Quality Requirements, experienced in operation and maintenance procedures and training.
- C. Preconstruction Meeting: Conduct conference at Project site to comply with requirements in Section 01 31 19.13 – Preconstruction Meeting. Review methods and procedures related to demonstration and training.

1.05 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:

- a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:

- a. Diagnosis instructions.
- b. Repair instructions.
- c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- d. Instructions for identifying parts and components.
- e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 - Operation and Maintenance Data.

3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.
- C. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 01 81 23

NOISE AND VIBRATION CONTROL

PART 1 - NOISE AND VIBRATION CONTROL

1.01 GENERAL

- A. This section the other acoustical performance requirement sections in Division 13 are the primary source of requirements for noise and vibration control in the project documents. Should conflicts arise between the requirements in these sections and other portions of the contract documents, the requirements in these sections shall take precedence unless otherwise directed by the Architect. Under no circumstances, however, shall the requirements in these sections take precedence over code or life safety requirements.
- B. Objectionable noise and vibration caused by building systems shall be reduced to levels as close as possible to the maximum allowable noise and vibration criteria required in this section. All necessary adjustments and retesting of equipment and systems to achieve the criteria shall be provided by the Contractor at no cost to the Owner.

1.02 MAXIMUM ALLOWABLE NOISE CRITERIA FOR PROJECT SPACES

- A. Maximum allowable background noise levels (NC) in project spaces due to operation of HVAC, plumbing or electrical equipment are listed below.

<u>Spaces</u>	<u>Required Background Noise Level</u>
Team Room and Offices	30
Locker Rooms	35
Weight Room	45

- B. Should the noise levels in any room exceed the above criteria, the Contractor shall be responsible for rebalancing, adjusting, or retesting required to meet the criteria, at no additional cost to the Owner.

1.03 MAXIMUM ALLOWABLE VIBRATION CRITERIA FOR ROTATING EQUIPMENT

- A. Rotating devices shall be balanced according to the schedule below. The following vibration displacement levels shall not be exceeded when the equipment is rigidly grounded to structure (with the isolators blocked or "grounded out.")

Equipment Type	RPM	mils peak to peak (max)
Fans	< 600	4
	600 to 999	3
	1000 to 2000	2
	> 2000	1
Pumps	1800	2
	3600	1

- B. Should any rotating equipment cause vibration exceeding the above criteria (or manufacturer's specifications), the Contractor shall be responsible for rebalancing, realignment, adjusting, or retesting required to meet the criteria, at no additional cost to the Owner.

1.04 SOUND POWER LIMITS FOR AIRHANDLING EQUIPMENT

- A. The sound generating characteristics of air handling units shall be tested to, and comply with, all requirements of this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has previous certified test results that can be made applicable to this project.
- B. Submit complete acoustical test reports showing that the proposed products have been tested in accordance with the latest versions of AMCA Standard 300, Test Code for Sound Rating, and AMCA Standard 301, Method for Calculating Fan Sound Ratings from Laboratory Test Data.
1. All sound power level measurements and calculations shall be made in complete accordance with the latest version of AMCA Standard 300, Test Code for Sound Rating, and AMCA Standard 301, Method for Calculating Fan Sound Ratings from Laboratory Test Data. Equivalent test and calculation procedures may be substituted for the above procedures if approved in advance by the Architect.
 2. The results of all testing shall be certified by the independent testing agency or an AMCA-approved testing laboratory and submitted to the architect for approval. The submittal shall include a complete description of the test conditions, methods and procedures, including the specific installation type used for the measurements, as detailed in AMCA 300-85.
- C. Maximum allowable sound power levels for airhandling equipment shall not exceed the values for the equipment used as the basis of design for this project and/or scheduled in the project drawings.

1.05 NOISE CONTROL FOR AIRHANDLING EQUIPMENT

- A. Silencers shall be provided as follows:
 - 1. For AC Units Serving Team Room, Offices, Locker Rooms and Weight Room:
 - a. Supply: Custom straight or elbow silencers silencer with special DIL and pressure drop requirements as scheduled in the project drawings.
 - b. Return: Custom straight or elbow silencers silencer with special DIL and pressure drop requirements as scheduled in the project drawings.
- B. 2"-thick lining shall be included in all exterior and interior ductwork, except in locations where 4" lining is shown or scheduled in the project documents.
- C. Minimum distances shall be provided between dampers and SA outlets or RA intakes as follows:
 - 1. Minimum 10' long spaces rated at NC-20.
 - 2. Minimum 7' long for spaces rated at NC-25.
 - 3. Minimum 5' long for spaces rated at NC-30 and above.
- D. Infill within rooftop curbs shall be as follows:
 - 1. For all AC Units: Minimum 2 layers of 5/8" gypsum board, "denseglass," or cement board within curb perimeter, cut carefully around duct penetrations and caulked airtight around ducts and curb perimeters.
 - 2. For all AHUs: Minimum 2 layers of 5/8" gypsum board, "denseglass," or cement board within curb perimeter, cut carefully around duct penetrations and caulked airtight around ducts and curb perimeters.

1.06 NOISE CONTROL FOR GRILLES, REGISTERS, AND DIFFUSERS

- A. Noise generation from grilles, registers, and diffusers shall be comply with all requirements of this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has certified test results for proposed products.
- B. Submittals shall be made in accordance with the following:
 - 1. Submit complete acoustical test reports showing that proposed products have been tested in accordance with latest editions of ASHRAE Standard 70 and ADC Standard 1062:GRD-84 and meet the maximum allowable noise criteria (NC) requirements specified below. Alternate procedures may be substituted for the above if approved in advance by the Architect.
 - 2. Submit a tabulation of proposed products, maximum allowable noise criteria, and product noise criteria (at specified air volumes) for all project spaces.

1.07 NOISE CONTROL FOR LIGHTING SYSTEMS

- A. Noise levels emanating from specified lighting equipment shall not exceed the maximum noise level requirements of this specification. A special test for this project is not required if the manufacturer has previous experience with similar installations.
- B. Submittals shall be made in accordance with the following:
 - 1. Submit complete acoustical test reports showing that proposed products have been tested for suitable operation in Project spaces with specified maximum noise criteria (NC) requirements.
 - 2. Submittals shall include a tabulation of proposed products, identification of Project spaces where proposed products are to be installed, maximum allowable NC for all Project spaces, and product NC for all Project spaces.

1.08 VIBRATION CONTROL FOR HVAC SYSTEMS

- A. Vibration isolation shall be provided at all vibration producing HVAC equipment on the project, unless otherwise directed by the Architect. Vibration-producing equipment includes, but is not limited to split system equipment, fan coil units, utility and exhaust fans, condensing units, rooftop ACUs and AHUs, etc.
- B. Schedules and details in the project documents shall not supersede the requirement for vibration isolation of all vibration-producing HVAC equipment unless directed by the Architect.
- C. Vibration isolation equipment includes, but is not limited to, equipment described in this section and mechanical drawings.
- D. Vibration or noise from HVAC equipment and systems shall not be transmitted to building structure and components, including, but not limited to, roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.
 - 1. Furnish all labor, equipment, and components necessary for HVAC equipment and system vibration control, including, but not limited to vibration isolators, bases, seismic restraints, incidental equipment, and related materials. Assure that deflection, stability and seismic restraint requirements are met. Install, test, and adjust all vibration isolation equipment per the manufacturer's instructions.
 - 2. Static deflections are specified and based on typical, anticipated equipment characteristics, particularly rpm. In the event the equipment proposed by the Contractor has characteristics other than typical and anticipated, the Manufacturer shall reevaluate the static deflections and propose corrections if necessary.
 - 3. The seismic resistance capability of all equipment shall be certified by a registered professional engineer in the state in which the project resides. The requirements of all applicable codes shall be met.

- E. Insure that functional integrity, structural integrity, and warranties of HVAC equipment and systems are not compromised by installation of vibration isolation equipment.
- F. Satisfy the requirements of all applicable codes.
- G. The vibration isolation equipment Manufacturer's shall be responsible for scheduling and providing all vibration isolation and seismic control equipment and have no less than five years experience in fabrication and delivery of such equipment. In addition, the vibration isolation equipment Manufacturer shall provide:
 - 1. Written installation instructions to the Contractor.
 - 2. Necessary visits to the jobsite before and after equipment is installed to identify pre-installation issues and post-installation discrepancies and necessary corrective work.
- H. The Contractor's responsibilities for vibration isolation on the project shall include the following.
 - 1. Rigorously avoid short-circuiting of vibration-isolated HVAC equipment and systems to building structure and components. Oversee all trades to prevent the short-circuiting of any vibration isolation system and bring conflicts to the Architect's attention.
 - 2. Remove temporary blocking washers and shims after equipment installations are complete and HVAC equipment and systems are at operation weight.
 - 3. Schedule final inspection(s) by the equipment Manufacturer after installation as needed. Obtain "rough-in" inspection by the Manufacturer of any installation to be covered or enclosed, prior to such closure.
 - 4. Adjust and/or replace all installations that are deemed defective in workmanship or materials by the Manufacturer or the Architect at no additional cost to the Owner.
- F. Submittals by the Manufacturer shall include the following:
 - 1. Manufacturer's recommended installation instructions and procedures, including written instructions and checklists to be delivered to the Contractor to aid in proper installation of manufacturer's equipment.
 - 2. A schedule indicating tag number, location and type of all vibration isolators. This shall be sufficiently clear to suffice as a checklist and index for design load, static deflection expected under the design load, specified minimum static deflection, additional deflection to solid under design load, ratio of spring height to spring diameter under design load.
 - 3. Shop drawings of seismic restraints, steel brackets, steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, and vibration isolator and seismic restraint mounting attachment methods.
 - 4. Calculations by a structural engineer licensed in the state in which the building is to be erected, certifying that all seismic restraints, bolts, cables and associated components will conform with all applicable code requirements.

5. List of any contract discrepancies or field conditions which will limit the performance of vibration isolation equipment and components.
- G. Submittals by the Contractor (at project completion) shall include the following:
1. A complete tabulation showing for each vibration isolator: (a) the actual static deflection measured at the project and (b) the specified minimum static deflection. Assistance from the vibration isolation equipment Manufacturer may be required.
 2. A report certifying a) that each piece of rotating mechanical equipment does not exceed the maximum displacement levels required in this section.
- H. Vibration isolation shall include (but is not limited to):
1. 2" deflection steel spring isolation for all ACUs and AHUs (via internal springs or external spring isolation curbs)
 2. 2" deflection steel spring isolation for all vibrating equipment associated with the chiller package.
 3. 1" deflection spring hangers for all suspended FCUs.
 4. 0.35" deflection neoprene mounts for air compressors.

1.09 VIBRATION CONTROL FOR PIPING SYSTEMS

- A. Vibration or noise from plumbing or HVAC piping shall not be transmitted to building structure and components, including, but is not limited to roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.
- B. Any active fluid piping running through/within the boundary of the Theatre shall include neoprene isolation either at hangers or within saddles.
- C. Ensure that functional integrity, structural integrity, and manufacturers warranties for piping systems are not compromised by installation of vibration isolation equipment.
- D. Satisfy the requirements of all applicable codes.

1.10 VIBRATION CONTROL FOR TRANSFORMERS

- A. Vibration or noise from plumbing or HVAC piping shall not be transmitted to building structure and components, including, but is not limited to roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.
 1. Support transformers on neoprene isolators sized for minimum static deflections of 0.2" under transformer load.
 2. All conduit connections to transformers shall be made resilient via sufficient lengths of flexible conduit (with wires pulled) to allow 1" free movement in any direction at mid span.

- B. Ensure that functional integrity, structural integrity, and manufacturers warranties for transformers are not compromised by installation of vibration isolation equipment.
- C. Satisfy the requirements of all applicable codes.

PART 2 - PRODUCTS FOR NOISE AND VIBRATION CONTROL

2.01 DUCT AND PLENUM LINER

- A. The sound absorbing characteristics of duct and plenum lining shall comply with this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has certified test results for proposed products.
- B. Submittals shall include octave band absorption coefficients and NRC values for specified thicknesses and densities of lining determined in accordance with the requirements of ASTM C 423 in an F-25 Mounting configuration. Submittals shall also include, but shall not be limited to, a complete description of the tested material and the test conditions, methods, and procedures.
- C. All sound absorption measurements and calculations shall be made in complete conformance with the latest revision of ASTM C 423, *Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method*, and ASTM E795, *Standard Practice for Mounting Specimens during Sound Absorption Tests*. Test specimens shall be tested in an F-25 Mounting configuration. Tests shall be conducted by a laboratory that is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) to conduct the test.
- D. Duct or plenum lining at specified thicknesses and densities shall have the following minimum octave band sound absorption coefficients when tested in the F-25 Mounting configuration in accordance with ASTM E 795:

	Octave Band Ctr. Frequency in Hertz					
	125	250	500	1000	2000	4000
1"-thick, 2.0pcf:	.15	.50	.55	.80	.85	.95
2"-thick, 2.0pcf	.25	.75	.90	.95	.95	.95
4"-thick, 2.0pcf	.60	.90	.95	.95	.95	.95

- E. Manufactured by Certainteed, Knauf, Johns Manville, Owens Corning, Gustin Bacon, or equal.

2.02 DUCT SILENCERS (SOUND TRAPS)

- A. A single Manufacturer shall be responsible for the design and fabrication of all duct silencers on the project. The Manufacturer shall have successful experience in

duct silencer production, including no less than five years experience in fabrication and delivery of duct silencers equal in size or quantity to this work. The Manufacturer shall be capable of supplying references and acoustical test results for up to five recently completed projects similar to this work.

- B. Duct silencer acoustical and aerodynamic performance shall be determined in accordance with the latest edition of ASTM Standard E 477 *Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers*. All tests shall be conducted by a laboratory that is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) for ASTM E 477. Where test data is obtained in the manufacturer's own laboratory, the facility shall be available for inspection and witness testing by the architect, mechanical engineer or acoustical consultant in order to verify compliance with the latest revision of ASTM E 477. The architect, mechanical engineer or the project acoustical consultant shall be the final arbiter in determining compliance with ASTM E 477.
- C. Submittals shall include, in tabular format, duct silencer type and size, maximum pressure drop at required air volume, dynamic insertion loss in octave bands centered at 63Hz through 8000Hz for both forward and reverse flow conditions in accordance with the latest edition of ASTM E 477, and self noise sound power levels in same octave bands as above in accordance with the latest edition of ASTM E 477.
- D. Minimum Acoustical and Aerodynamic Performance Requirements: As scheduled or shown in the project documents, and as used in the basis of design (listed above).
- E. Duct silencer baffles should be oriented so as to be parallel to the plane of the turn if the duct silencer is located in a position less than 3 duct diameters in distance from the elbow. The duct diameter shall be based upon the maximum duct cross sectional dimension of the duct silencer. If the duct silencer is located greater than 3 duct diameters away from an elbow, the orientation of baffles is not critical.
- F. Manufactured by Vibro-Acoustics, Industrial Acoustics, Commercial Acoustics, or equal.

2.03 ACOUSTICAL FLEXIBLE DUCT

- A. Flexible insulated round duct, with sound-transparent inner liner constructed of spun-bonded nylon.
- B. Install in all rooms scheduled for background noise levels or NC-35 or less.
- C. Must comply with all applicable codes and UL requirements.
- D. "Silent-Flex II" by Casco, "AP" by J.P. Lamborne and Company, or equal.

2.04 VIBRATION AND SEISMIC CONTROL PRODUCTS

- A. Manufactured by Amber/Booth Company, Mason Industries Inc., Peabody Noise Control Inc., M. W. Sausse and Co., or equal.

- B. All vibration isolation and seismic restraint equipment shall be warranted against defective workmanship, operation and materials for the life of the equipment supported by these items.
- C. Vibration isolation devices shall include (but are not limited to) the following:
 - 1. Extra Thick Neoprene Pad: "Super W" by Mason or approved equal.
 - 2. Neoprene Bushing: "HG" by Mason or approved equal.
 - 3. Neoprene Isolator (with Integral Seismic Restraint): "BR" by Mason or approved equal.
 - 4. Steel Spring Isolator (with Integral Seismic Restraint): "SSLFH" by Mason, "FYS" by Peabody or approved equal.
 - 5. Neoprene Isolation Hanger: "BRD" by A/B, "HD" by Mason, "RH" by Peabody or approved equal.
 - 6. Steel Spring Isolation Hanger: "30" by Mason or approved equal.
 - 7. Vibration Isolation Curb: "CMAB" by Mason, "ASR" by Peabody or approved equal.
- D. Flexible Connectors and Sleeves
 - 1. Flexible Pipe Connectors: "MFTNC, MFNEC or MFTFU" by Mason or approved equal.
 - 2. Flexible Duct Connectors: "KNC-100B" by Peabody or equal.
 - 3. Flexible Electrical Connection: Flexible conduit installed grossly slack.
 - 4. Field-Fabricated Resilient/Airtight Sleeve: Oversized sleeve around pipe, conduit, or duct penetration. 1" clearance all around penetrating element, packed with glass fiber and sealed with at least 1/2" deep bead of acoustical sealant.

PART 3 - COMMISSIONING REQUIREMENTS

3.01 NOISE MEASUREMENTS / HVAC SYSTEM ADJUSTMENTS

- 1. Noise levels shall be quantified in all project spaces and compared with the specified maximum allowable Background Noise Criteria (NC) as part of the testing, adjusting and balancing process, or as part of the HVAC commissioning process. Insofar as possible under the jurisdiction of the Air Balance Contractor and the Mechanical Contractor, adjustments shall be made to airhandling equipment to insure that maximum NC are not exceeded in any project space.
- 2. Submittals shall include the following:
 - a. Proposed test procedure and measurement equipment before beginning work.
 - b. Final air balance report, including tabulation of reject space by room number, specified maximum NC, measured NC at each measurement location, octave band sound levels in dB from 63 Hz to 8000 Hz plotted on NC curves at each measurement location, and notes relating to additionally encountered noise sources (other than HVAC).

3. The same Air Balance Contractor shall be responsible for all aspects of air balancing including all sound level measurements. The Air Balance Contractor shall have successful experience in air balancing and sound level measurements including no less than five years experience on projects equal to the size and complexity of this work.
4. Measurement equipment shall be recently-calibrated Type 1 Sound Level Meter with Class II Octave Band Filters and 1/2" random-incidence microphone.
5. The procedure for noise measurements shall be as follows:
 - a. Sound pressure level measurements shall be made at 5' above floor level in each project space in all octave bands centered between 63 Hz and 8000 Hz, inclusive.
 - b. For spaces up to 100 square feet in size, one measurement shall be provided in the center of each room. For spaces between 101 and 200 square feet in size, two measurements shall be provided in the center of each half of the room. For spaces above 201 square feet in size, four measurements shall be provided in the center of each quadrant of the room.
 - c. Measured levels shall be recorded in decibels (re .0002 microbar) on paper in tabular form and plotted against NC curves for the record. Testing shall be accomplished only during periods when no other trades are working within the building outside noises are at a minimum. Make note of and record on paper all noise sources which cannot be removed, such sources might include electrical, lighting, and plumbing systems.
 - d. Rebalance or adjust all airhandling equipment causing noise in spaces in excess of maximum allowable NC. Re-measure sound levels in all such spaces to show compliance with maximum allowable NC. Repeat until noise is minimized to the satisfaction of the Architect, Mechanical Engineer, and Acoustical Consultant.

3.02 VIBRATION ISOLATION SYSTEM ADJUSTMENTS

1. After each equipment unit installation is complete and under full operational load, vibration isolators shall be adjusted so that loads are transferred to them and away from temporary blocking washers and shims. Blocks and shims then shall be removed and used as gauges to judge required clearances. Washers shall be moved away.
2. Inspect all vibration-isolated equipment, coordinate the work of all involved trades, and see that vibration isolators are not short-circuited by seismic restraints, drain lines, conduits, stanchions, control tubing, duct connections, pipe connections, etc. Ensure that hanger isolators and their rods or wires do not touch any other building component.

END OF SECTION 01 81 23

**SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Owner's Project Requirements, Basis of Design, and Commissioning Plan documentations are included by reference for information only.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building commissioning of the following systems:
 - a. HVAC components and equipment, domestic hot water systems, energy management, control systems.
 - b. HVAC system: Interaction of cooling, heating, and comfort delivery systems.
 - c. HVAC Control System: Control hardware and software, sequence of operations, and integration of factory controls.
 - d. Lighting Control System and interface with daylighting.
 - e. Water heater Title 24 compliant.
 - 2. Building commissioning activities and documentation in support of the 2022 California Energy Code and 2022 California Green Building Standards Code - CALGreen.
 - a. Verify that applicable equipment and systems are installed according to the Contract Documents, manufacturer's recommendations, and industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - b. Verify and document proper performance of equipment and systems.
 - c. Verify that Operation and Maintenance documentation is comprehensive and complete.
 - 3. Verify that Owner's operating personnel are adequately trained.
 - 4. Building commissioning is a process for achieving, verifying, and documenting that the performance of the facilities, systems, and assemblies meet defined objectives and criteria. The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meets the Owner's/Architect's design intent.
- B. The Owner, Architect/Engineer, and Commissioning Agent are not responsible for construction means, methods, job safety, or management function related to commissioning on the job site.
- C. Related Work Specified Elsewhere (as applicable):
 - 1. SUBMITTAL PROCEDURES
 - 2. CLOSEOUT PROCEDURES
 - 3. OPERATION AND MAINTENANCE DATA
 - 4. PROJECT RECORD DOCUMENTS
 - 5. PLUMBING
 - 6. HVAC/HVAC CONTROLS
 - 7. ELECTRICAL

1.3 DEFINITIONS

- A. Acceptance - A formal action, taken by a person with appropriate provider (which may or may not be contractually defined) to declare that some aspect of the Project meets defined requirements; thus permitting subsequent activities to proceed.
- B. Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.
- C. Checklists - Verification checklists that are developed and used during all phases of the commissioning process to verify that the Owner's project requirements are being achieved. This includes checklists for general verification, plus testing, training, and other specific requirements. Various checklists are prepared by the Commissioning Agent and the contractor to document equipment; system test completion.
- D. Commissioning - Commissioning is a comprehensive and systematic process to verify that the building systems perform as designed to meet the Owner's requirements. Commissioning during- the construction, acceptance, and warranty phases is intended to achieve the following specific objectives:
 - 1. Verify and document that equipment is installed and started per manufacturer's recommendations; industry accepted minimum standards, and the Contract Documents.
 - 2. Verify and document that equipment and systems receive complete operational checkout by installing contractors.
 - 3. Verify and document equipment and system performance.
 - 4. Verify the completeness of operations and maintenance materials.
 - 5. Ensure that the Owner's operating personnel are adequately trained on the operation and maintenance of building equipment.The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.
- E. Commissioning Plan - an overall plan developed by the Commissioning Agent that provides the structure, schedule, and coordination planning for the commissioning process.
- F. Control System - A component of environmental, HVAC, security, and fire systems for reporting/monitoring and issuing of commands to/from field devices.
- G. Data Logging - The monitoring and recording of flows, currents, status, pressures, etc., of equipment using stand-alone data recorders separate from the control system or the trending capabilities of control systems.
- H. Deficiency - A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents, does not perform properly or is not complying with the design intent.
- I. Design Intent - A dynamic document that provides the explanation of the ideas, concepts, and criteria that are considered to be very important to the Owner. It is initially the outcome of the programming and conceptual design phases.

- J. Functional Performance Test - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure set point). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing is not functional testing, in the commissioning sense of the word. Test and balancing primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The Commissioning Agent develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. Functional Performance Tests are performed after pre-functional checklists and startups are complete.
- K. Issues Log - A formal and ongoing record of problems or concerns - and their resolution - that have been raised by members of the commissioning team during the course of the commissioning process.
- L. Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- M. Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.
- N. Non-Compliance - see Deficiency.
- O. Non-Conformance - see Deficiency.
- P. Owner's Design Intent (ODI) - A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes Project goals, measurable performances criteria, cost considerations benchmarks, success criteria, and supporting information.
- Q. Pre-functional Checklist - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the Commissioning Agent to the contractor. Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The word "pre-functional" refers to before functional testing. Pre-functional checklists augment and are combined with the manufacturer's start-up checklist.
- R. Quality Based Sampling - A process for evaluating a subset (sample) of the total population. The sample is based upon a known or estimated probability distribution of expected values; an assumed statistical distribution based upon data from a similar product, assembly, or system; or a random sampling that has scientific statistical basis.

- S. Seasonal Performance Tests - Functional Performance Test that are deferred until the system(s) will experience conditions closer to their design conditions based on weather conditions.
- T. Simulated Condition - Condition that is created for the purpose of testing the response of a system (e.g.: raising/lowering the set point of a thermostat to see the response of a VAV box).
- U. Startup - The initial starting or activating of dynamic equipment, including completing construction checklists.
- V. System Manual - A system focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner during the occupancy and operations phase.
- W. Procedure - A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems. The test procedures are specified in the Technical Specifications sections on the Contract Documents. Performance testing covers the dynamic functions and operations of equipment and systems under full operation. Systems are tested under various models; such as during low cooling loads, high loads, component failures, unoccupied, varying outside air, fire alarm, power failure, etc. The systems are run through all the sequences state.
- X. Training Plan - A written document that details the expectations, schedule, budget, and deliverables of commissioning process activities related to training of project operating and maintenance personnel, users, and occupants.
- Y. Trending - The monitoring by a building management system or other electronic data gathering equipment, and analyzing of the data gathered over a period of time. Trending of all equipment control points is required prior to functional testing.
- Z. Verification - The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.
- AA. Warranty Period - Warranty period for the entire project; including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.4 COORDINATION

- A. Perform commissioning services to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
- B. Commissioning Agent shall provide overall coordination and management of the commissioning program as specified herein.
- C. Commissioning Team: The commissioning process will require cooperation of the Contractor, subcontractors, vendors, installers, Architect/Engineer, Commissioning Agent, and Owner. The commissioning team shall be comprised of the following.
 - 1. Contractor
 - a. Project Manager
 - b. Test Engineer

GENERAL COMMISSIONING REQUIREMENTS

2. Subcontractors: As appropriate to product or system being commissioned.
 3. Commissioning Agent
 - a. Project Manager
 - b. Project Engineers
 4. Owner Representative(s)
 5. Architect/Engineer
 - a. Architect
 - b. MEP Engineers
 - c. Specialty Consultant(s)
- D. Progress Meetings: Attend construction job-site meetings, as necessary, to monitor construction and commissioning progress. Coordinate with contractor to address coordination, deficiency resolution and planning issues. Plan and coordinate additional meetings as required to progress the work.
- E. Site Observations: Perform site visits, as necessary, to observe component and system installations.
- F. Functional Testing Coordination:
1. Equipment shall not be "temporarily" started for commissioning.
 2. Functional performance testing shall not begin until pre-functional, start-up, and test and balancing is completed for a given system.
 3. The controls system and equipment it controls shall not be functionally tested until all points have been calibrated and pre-functional checklists are completed.

1.5 QUALITY CONTROL

- A. Qualifications for Commissioning Agents: Engaging commissioning service personnel that specialize in the types of inspections and tests to be performed.
1. Inspection and testing service agencies shall be members of the Building Commissioning Association (BCA).

1.6 SUBMITTALS

- A. Commissioning Agent shall submit the following:
1. Basis of Design and Design Intent.
 - a. Update as necessary during the work to reflect the progress on the components and systems. Forward updates to the Architect/Engineers in a timely manner.
 2. Scoping Meeting Minutes.
 3. Commissioning Plan: Submit within 30 calendar days of authorization to proceed.
 - a. Update as necessary during the work to reflect the progress on the components and systems. Forward updates to the Architect/Engineers in a timely manner.
 4. Commissioning Schedule: Submit with Commissioning Plan.
 - a. Update as necessary during the work to reflect the progress on the components and systems. Forward updates to the Architect/Engineers in a timely manner.
 5. Functional performance test forms: Submit minimum 30 calendar days prior to testing.
 6. Deficiency Report and Resolution Record: Document items of non-compliance in materials, installation or operation. Document the results from start-up/pre-functional checklists, functional performance testing, and short-term diagnostic monitoring. Include details of the components or systems found to be non-compliant with the drawings and specifications. Identify adjustments and

alterations required to correct the system operation, and identify who is responsible for making the corrective changes.

- a. Update as necessary during the work to reflect the progress on the components and systems. Forward updates to the Architect/Engineers in a timely manner.
7. Final Commissioning Report: Compile a final Commissioning Report. Summarize all of the tasks, findings, conclusions, and recommendations of the commissioning process. Indicate the actual performance of the building systems in reference to the design intent and contract documents. Include completed pre-functional inspection checklists, functional performance testing records, diagnostic monitoring results, identified deficiencies, recommendations, and a summary of commissioning activities.
8. O&M Submittals:
 - a. Training plan: Training plan shall include for each training session:
 - Dates, start and finish times, and locations;
 - Outline of the information to be presented;
 - Names and qualifications of the presenters;
 - List of texts and other materials required to support training.
 - b. O&M Database.

1.7 RESPONSIBILITIES

- A. The general responsibilities of various parties in the commissioning process are provided in this subsection. The specific responsibilities are in the Technical Specifications.
- B. All Parties:
 1. Follow all quality requirements in the Contract Documents.
 2. Attend commissioning kickoff meeting and additional coordination meetings as necessary.
- C. Architect (A/E):

Construction Phase

 1. Attend the commissioning coordination meeting and selected commissioning team meetings.
 2. Perform normal submittal review, construction observation, as-built drawing review; O&M manual review, etc., as contracted.
 3. Provide design narrative documentation to Commissioning Agent.
 4. Coordinate resolution of system deficiencies identified during commissioning; according to the Contract Documents.
 5. Review and approve the O&M manuals.
- D. Mechanical and Electrical Engineers (A/E)

Construction Phase

 1. Perform normal submittal review, construction observation, as-built drawing review, etc.; as contracted. One site observation should be completed just prior to system startup.
 2. Provide any design narrative and sequences documentation requested by the Commissioning Agent. The engineers shall assist in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings, or equipment documentation is not sufficient for writing detailed testing procedures.
 3. Attend the commissioning meetings as necessary.
 4. Participate in the resolution of system deficiencies identified during commissioning; according to the Contract Documents.

5. Review and approve the O&M manuals.

Occupancy and Operations Phase

1. Participate in the resolution of non-compliance, non-conformance, and design deficiencies identified during commissioning during warranty period commissioning.
2. Attend lessons learned session.

- E. Commissioning Agent: The Commissioning Agent will verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the Owner's Design Intent. When a random sample does not meet the requirement; the Commissioning Agent will report the failure in the "Issues Log".

Construction Phase

1. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications with all necessary parties, frequently updated timelines and schedules and technical expertise.
2. Coordinate the commissioning work and; with the General Contractor and Owner/CM, help integrate commissioning activities into the Master Schedule.
3. Revise the Commissioning Plan as necessary.
4. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
5. Request and review additional information requested to perform commissioning tasks; including O&M materials, contractor startup and checkout procedures.
6. Before startup; gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained in writing to be able to write detailed testing procedures.
7. Review and approve contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
8. Write and distribute construction checklists. Prepare and maintain completed construction checklist log.
9. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitution relating to the commissioning process. Assist in resolving any discrepancies.
10. Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
11. Approve construction checklist completion by selected site observation and spot-checking.
12. Recommend approval of systems startup by reviewing startup reports and by selected site observation.
13. Review test and balancing execution plan.
14. Oversee sufficient testing of the HVAC control system.
15. Recommend approval of air and water systems balancing by spot testing by reviewing completed reports and by selected sit observation.
16. With necessary assistance and review from installing contractors; write the performance test procedures for equipment and systems; including energy management control system trending, stand-alone data logger monitoring or manual performance testing.

17. Analyze any performance trend logs and monitoring data to verify performance.
18. Coordinate, witness, and recommend approval of manual performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
19. Maintain a master Issues Log and a testing record. Provide the commissioning team with progress reports, test results, and recommended actions.
20. Witness all or part of all Owner contracted tests or tests by manufacturer's personnel over which the Commissioning Agent may not have direct control. Document these tests and include this documentation in Commissioning Record in O&M manuals.
21. Review equipment warranties to ensure that the owner's responsibilities are clearly defined.
22. Oversee and approve the training of the owner's operating personnel.
23. Complete and maintain a commissioning record and building systems book(s).
24. Review and approve the preparation of the O&M manuals.
25. Provide a final commissioning report.
26. Coordinate the development of a systems manual.
27. Prepare a standard trend logging package of primary parameters that will provide the operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems. The Commissioning Agent shall also provide any needed information on interpreting trends.

Occupancy and Operations Phase

1. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
2. Return to the Site/Project on or about 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
3. Assist in the development of a preventative maintenance plan, a detailed operating plan or an energy and resource management plan or as-built documentation.
4. Attend and facilitate lessons learned session.

F. Owner or Owner's Representative (CM)

Construction and Acceptance Phase

1. Attend a commissioning coordination meeting and other commissioning team meetings.
2. Perform the normal review of contractor submittals.
3. Furnish a copy of all Construction Documents, Addenda, Change Orders, and approved submittals.
4. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
5. Provide the Owner's Design Intent documentation to the Commissioning Agent and contractor for information and use.
6. Provide the Basis of Design documents; prepared by the Architect and approved by the Owner to the Commissioning Agent and operation and maintenance training plan.
7. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

Occupancy and Operations Phase

1. Assist the Commissioning Agent as necessary in the seasonal or deferred testing and deficiency correction required by the specifications.
2. Attend lessons learned session.

G. Owner's Project Manager (PM)

Construction Phase

1. Manage the contract of the Architect/Engineer and the General Contractor.
2. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
3. Provide final approval for the completion of the commissioning work.

Occupancy and Operations Phase

1. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
2. Attend lessons learned session.

H. Contractor: Contractor, their subcontractors, and vendors shall assign representatives with expertise and authority to act on their behalf and schedule them to participate in and perform commissioning process activities including, but not limited to the following:

Construction Phase

1. Perform customary quality control on all work performed under this contract.
2. Prepare O&M manuals, as-built drawings, construction observation, etc. according to the Contract Documents; including clarifying and updating the original sequences of operation to as-built/as-tested conditions.
3. Provide startup procedures for all equipment prior to equipment startup/testing.
4. Attend one commissioning coordination meeting at the beginning of construction.
5. Facilitate the commissioning coordination of the commissioning with the construction schedule.
6. Ensure that all subcontractors and vendors execute their installation, testing, and startup responsibilities as defined in this section and the technical specifications.
7. Provide submittals as required elsewhere in the contract including all changes thereto.
8. Participate in intermittent commissioning discussions held during weekly construction meetings.
9. Attend one commissioning meeting to coordinate equipment functional testing approximately 60 days prior to startup of the first piece of major equipment. Meeting will be chaired by the Commissioning Agent and may include various owner representatives including the CM, A/E, and PM.
10. Provide training of owner personnel as identified in contract specifications.
11. Provide trend logs and trend reports of all equipment control points to aid in demonstration of proper control sequence of operations prior to functional testing.

Occupancy and Operations Phase

1. Ensure that subcontractors complete all quality requirements identified in the contract specifications.
2. Ensure that subcontractors correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings as the project progresses.
3. Perform all guarantee work for materials furnished under the contract for the time specified in the contract; including all warranties and curing all latent defects within the time period provided in the contract.

I. Vendors/Subcontractors

1. Analyze specified products and verify that the A/E has specified the newest, most current equipment reasonable for this project's scope and budget.

2. Provide requested information regarding equipment sequence of operation and testing procedures as required in contract specifications.
3. Provide copy of all quality assurance test results/reports for equipment installed by factory representatives.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

- A. Instrumentation shall meet the following standards:
 1. Be of sufficient quality and accuracy to test and measure system performance within the tolerances required to determine adequate performance.
 2. Be calibrated on the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument being used.
 3. Be maintained in good repair and operation condition throughout the duration of use on this project.
- B. All standard testing equipment required to perform startup, initial system checkout, and required functional performance testing shall be provided by the contractor for the equipment being tested. Any specialized testing equipment not required to perform contract work will be provided by the Commissioning Agent.
- C. Data logging equipment or software required to test equipment will be provided by the Commissioning Agent, but shall not become the property of the Owner.

2.2 COMMISSIONING PLAN

- A. The Commissioning Agent is to develop a Commissioning Plan identifying the quality assurance processes to be implemented by the Owner. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
 1. Commissioning during construction begins with an initial commissioning meeting conducted by the Commissioning Agent where the commissioning process is reviewed the project commissioning team members.
 2. Additional meetings will be required throughout construction; scheduled by the Commissioning Agent through the Owner or CM with necessary parties attending to plan, scope, coordinate, schedule future activities and resolve problems.
 3. Equipment documentation is submitted to the Commissioning Agent through the Owner or CM during the normal submittal process; including detailed startup procedures.
 4. The pre-functional checklists are to be completed by the contractor prior to startup to demonstrate equipment is ready for startup.
 5. Pre-functional checklists, equipment startup, trend logging and reporting, and test and balancing must be completed before functional performance testing.
 6. Items of non-compliance in material, installation, or setup shall be corrected at no expense to the Owner.
 7. The contractor ensures that the subcontractors' construction checklists are executed and documented and that startup and initial checkout are performed. The Commissioning Agent approving test and balancing, and checklists and startup plans. This also includes witnessing startup of selected equipment. Any testing failure is to be corrected at no additional cost to the Owner, and a re-test is to be performed, observed, and documented.
 8. The Commissioning Agent develops and implements equipment and system performance test procedures. These procedures are approved by the Owner and CM.

GENERAL COMMISSIONING REQUIREMENTS

9. The performance tests are executed by the contractor under the direction of the Commissioning Agent with the assistance of the facility staff. All documentation is by the Commissioning Agent.
10. The Commissioning Agent reviews the O&M documentation for completeness and provides the commissioning record for the O&M manuals.
11. Commissioning is to be completed before substantial completion.
12. The Commissioning Agent assists in the development and reviews and pre-approves the training program provided by the contractor.
13. Deferred testing is conducted as specified or required.

2.3 EQUIPMENT / SYSTEMS TO BE COMMISSIONED

- A. The following equipment /systems will be commissioned in this Project:
1. Domestic water system - plumbing (Level 3)
 2. HVAC ductwork and distribution system (Level 4)
 3. HVAC equipment (Level 4)
 4. HVAC instrumentation (Level 4)
 5. HVAC test and balance (Level 5)
 6. Interior and Exterior Lighting and Controls (Level 3)

Note: Levels defined in 3.4 PERFORMANCE TESTING AND VERIFICATION

PART 3 EXECUTION

3.1 MEETINGS

- A. Commissioning Coordination Meeting - Within 60 days of the Notice to Proceed (NTP), the Commissioning Agent, through the Owner/CM, will schedule, plan, and conduct an initial commissioning meeting. The contractor and its responsible parties previously identified shall attend.
- B. Commissioning Agenda Discussions - At various times during the course of construction, commission related agenda will be discussed during the weekly project meetings along with other quality related discussions. These discussions will be held weekly during the final 3 months of construction.
- C. Functional Testing Meetings - Prior to HVAC equipment startup a commissioning meeting will be conducted to coordinate commissioning activities with equipment startup and testing.

3.2 COMMISSIONING PROCESS

- A. The following activities outline the commissioning tasks and the general order in which they occur.
1. The Commissioning Agent shall coordinate all activities.
 - a. Design Review and Documentation.
 - b. Documentation of Basis of Design and Design Intent.
 - c. Design Development Review.
 2. Construction Document Review.
 3. Commissioning Scoping Meeting.
 4. Commissioning Plan.
 5. Submittals Review.
 6. Start-Up/Pre-Functional Checklists.
 7. Functional Performance Testing.
 8. Short-Term Diagnostic Testing.

9. Deficiency Report and Resolution Record.
10. Operations and Maintenance Training.
 - a. O&M Manual.
 - b. Training.
 - c. O&M Database.
11. Record Documents Review.
12. Final Commissioning Report and Documentation.
13. Deferred Testing.
 - a. Unforeseen Deferred Tests.
 - b. Seasonal Testing.
 - c. End-of-Warranty Review.

3.3 SUBMITTALS

- A. The Commissioning Agent will provide appropriate contractors with a specific request for the type of submittal documentation the Commissioning Agent requires facilitating the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum; the request will include the manufacturer and model number, the manufacturer's printed installation and detailed startup procedures, full sequence of operation, O&M data, performance test procedures, trend data, and logs/reports, control drawings, and details of owner contracted tests. In addition; the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the commissioning agent All documentation requested by the Commissioning Agent will be included by the subcontractors in their O&M manual contributions.
- B. The Commissioning Agent will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the performance of the equipment, and adequacy for developing test procedures. This review is intended primarily to aid in the development of performance and only secondarily to verify compliance with equipment specifications. The commissioning agent will notify the Owner/CM of items missing or areas that are not in conformance with Contract Documents and which require resubmission.
- C. The Commissioning Agent may request additional design narrative from the NE and controls contractor, depending on the completeness of the Owner's Design Intent documentation and sequences provided with the plans and specifications.
- D. These submittals to the Commissioning Agent do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the contractor; though the Commissioning Agent will review and approve them.

3.4 PERFORMANCE TESTING AND VERIFICATION

- A. Requirements - All systems shall be performance tested and verified to demonstrate that each is operating according to the documented design intent and contract documents. Performance testing facilitating bringing the systems from a state of individual equipment level completion to full dynamic system operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
 1. Level 1 - The Commissioning Agent will periodically observe and inspect the installation of the building systems and may review project documentation to verify operational requirements meet the ODI.

2. Level 2 - The Commissioning Agent will perform Level 1 activities and review inspection reports, test reports, and project deficiency lists prepared by others to verify operational requirements are met.
 3. Level 3 - The Commissioning Agent will perform Level 2 activities and inspect, witness testing, and/or operations of the system to verify operational requirements are met. These activities will be performed independently of the contractor.
 4. Level 4 - The Commissioning Agent will perform Level 2 activities and will witness contractor performance testing of the system. Contractor shall test up to 20% of the system to prove operational requirements are met. The test sections shall be chosen at random by the Commissioning Agent to ensure uniformity of the system. Failure of any test section shall require retesting of that section and an additional test section equivalent in scope. Coordination will be required to avoid impact to the construction schedule.
 5. Level 5 - The Commissioning Agent will perform Level 2 activities and will witness contractor performance testing of the system. Contractor shall test up to 100% of the system to prove operational requirements are met. Failure of any test section shall require retesting of that section. Coordination will be required to avoid impact to the construction schedule.
- B. Coordination and Scheduling - The contractor shall provide sufficient notice regarding their completion schedule for the pre-functional checklists, startup of all equipment, test and balancing, and controls systems completion to allow the performance verification to be scheduled. The commissioning team shall oversee, witness, and document the performance of all equipment and systems. The Commissioning Agent in association with the contractor/subcontractors and facility staff shall execute the tests. Performance verification testing shall be conducted only after the contractor has documented the systems are complete and operational; meeting contract requirements. The control system shall be sufficiently tested and approved by the Commissioning Agent before it is used and trend data/logs and reports provided to verify performance of all components or systems. The air and water balancing shall be completed before performance testing of air or water related equipment or systems. Testing proceeds from components to sub-systems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems shall be checked.
- C. Development of Test Procedures - Before test procedures are finalized; the contractor shall provide the A/E and the Commissioning Agent all requested documentation and a current list of changes affecting equipment or systems; program code, control sequences, and testing parameters. Using the testing parameters and requirements in the technical specifications, the Commissioning Agent shall update/develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each contractor/subcontractor or vendor, as appropriate, shall provide assistance to the Commissioning Agent in developing the final procedures. Prior to finalization, the A/E shall review and concur with the test procedure.
- D. Test Methods
1. Performance testing and verification may be achieved by manual testing or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The Commissioning Agent may substitute specified methods or require an additional method to be executed other than what was specified, with the approval of the Owner/CM. The Commissioning Agent will determine which method is most appropriate for tests that do not have a specified method.

2. Simulated Conditions - Simulating conditions shall be allowed; though timing the testing to experience actual conditions is encouraged whenever practical.
3. Overridden Values - Overriding sensor values to simulate a condition; such as overriding the outside air temperature reading in a control system to be something other than it really is, is acceptable.
4. Simulated Signals - Using a signal generator which creates a simulated signal to test and calibrate transducers and direct digital control constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overridden values.
5. Altering Setpoints - Rather than overriding sensor values; and when simulating conditions is difficult, altering Setpoints to test a sequence is acceptable.
6. Indirect Indicators - Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the test parameters, that the indirect readings through the control system represent actual conditions and responses.
7. Setup - Each performance test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The contractor/subcontractor(s) assisting the Commissioning Agent in executing the test shall provide all necessary materials, system modifications, etc., to produce the necessary flows, pressures, temperatures, etc., necessary to execute the test according to the specified conditions. At completion of the test, the contractor/subcontractor(s) shall return all affected equipment and systems to their approved operating settings.

- E. Problem Solving - The burden of responsibility to solve, correct, and retest malfunctions/failures is with the contractor.

3.5 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

- A. Documentation - The Commissioning Agent shall witness and verify/pre-approve the documentation of the results of all functional performance tests.
- B. Non-Conformance
1. Corrections of minor deficiencies identified may be made during the tests at the discretion of the Commissioning Agent. In such cases the deficiency and resolution will be documented on the procedure form or on an attached sheet.
 2. Cost of retesting a performance test shall be borne by the contractor.
 3. The contractor shall submit in writing to the CM at least as often as commissioning meetings are being scheduled. The status of each outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreement and proposals for their resolutions.
 - a. The Commissioning Agent retains the original non-conformance forms until the end of the project.
 - b. Retesting shall not be considered a justified reason for a claim of delay or for a time extension by the contractor.
- C. Approval - The Commissioning Agent notes each satisfactory demonstrated function on the test form. Final approval of the performance test by the Owner is made after review by the Commissioning Agent.

3.6 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If a test cannot be completed due to the building structure, required occupancy condition, or other deficiency, the functional testing may be delayed upon recommendation of the Commissioning Agent and the approval of the Owner.

These tests are conducted in the same manner as the seasonal tests as soon as possible.

- B. Seasonal Testing:
 - 1. Schedule, coordinate, observe, and document additional testing for seasonal variation in operations and control strategies during the opposite season to verify performance of the HVAC system and controls. Complete testing during the warranty period to fully test all sequences of operation.
 - 2. Update O&M manuals and Record Documents (As Built Drawings) as necessary due to the testing.
- C. End-of-Warranty Review: Conduct end of warranty review prior to the end of the warranty period. Review the current building operation with the facility maintenance staff. The review shall include outstanding issues from original or seasonal testing. Interview facility staff to identify concerns they may have with building operation. Provide suggestions for improvements and assist owner in developing reports or documentation to remedy problems.
 - 1. Update O&M manuals and Record Documents (As Built Drawings) as necessary due to the testing.

3.7 SYSTEMS MANUAL / OPERATIONS AND MAINTENANCE MANUALS / DATA

- A. Commissioning Record and O&M Manuals.
 - 1. The Commissioning Agent will prepare a Systems Manual documenting the commissioning process and identifying operational requirements and parameters for future retesting. The systems manual will include:
 - a. O&M manuals prepared by the General Contractor.
 - b. The Commissioning Plan.
 - c. System reports including design narratives and criteria including sequences. Each system shall contain the startup plan and report, approvals, corrections, construction checklists, completed performance tests, trending and analysis, training plan, and recommended recommissioning schedule.
 - d. Final Commissioning Report including an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the Commissioning Agent regarding the adequacy of the equipment, documentation, and training meeting the contract Documents in the following areas: 1) equipment meeting the equipment specifications, 2) equipment installation, 3) performance and efficiency, 4) equipment documentation and design intent, and 5) operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc., shall also be listed. Each non-compliance issue shall be referenced to the specific performance test, inspection, trend log, etc. where the deficiency is documented. The performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, Building Automation System trend logs, data loggers, etc.) and include observations and conclusions from the testing.

3.8 TRAINING OF OWNER PERSONNEL

- A. The contractor shall provide training coordination, scheduling of subcontractors, and ensure that training is completed. All training shall be coordinated through the CM with the Commissioning Agent.
- B. The contractor shall ensure that each subcontractor and vendor (mechanical, plumbing, fire, electrical, specialty, etc.) shall have the following responsibilities:
 - 1. Provide to the Commissioning Agent through the CM a training plan sixty (60) days before the planned training covering the following elements:
 - a. Equipment
 - b. Intended audience
 - c. Location of training
 - d. Objectives
 - e. Subject covered (description, duration of discussion, special methods, etc.)
 - f. Duration of training on each subject
 - g. Instructor for each subject
 - h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.)
 - 2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
 - 3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.

END OF SECTION 01 91 13

SECTION 02 21 00
SURVEYS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

- A. Section relates to execution of survey construction staking and addresses the following:
 - 1. Personnel and applicable responsibilities for surveying and staking.
 - 2. Procedures and time limitations.
 - 3. Consideration of monuments and damage.
- B. Contractor shall furnish and set construction stakes and marks to establish the lines and grades required for completion of the Work as shown on the Plans and specified in the Project Specifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

- A. Construction staking shall be performed under the direction of a licensed land surveyor or registered professional Engineer familiar with construction surveying and staking.
- B. Construction staking shall be performed as necessary to control the Work. Construction stakes and marks shall be furnished and set with accuracy adequate to assure that the completed Work conforms to the lines, grades, and sections shown on the Plans.
- C. Contractor shall provide a construction staking request in writing to Owner and the Engineer no less than 72 hours prior to the desired time for construction staking to be performed.
- D. Construction stakes shall be removed from the site by Contractor when no longer needed. Removal and disposal of construction staking materials is the sole responsibility of Contractor.
- E. In the event Contractor's operations destroy any of the survey control points, Contractor shall replace such control points at his expense, subject to verification by the Engineer. The cost of any such verification or replacement of the control surveys will be the sole responsibility of Contractor with no additional cost to Owner. Contractor will not be allowed any adjustment in Contract Time for such verification or replacement of survey control points.
- F. Contractor must preserve all Geographic Reference Stations, section corners, and all other legal property monuments of any kind during all construction and related activities. It is Contractor's responsibility to become familiar with the survey control and documentation of the site and surrounding property prior to conducting activities on the site that may potentially jeopardize such facilities.

- G. Contractor shall give written notice to Owner and the Engineer at least five (5) working days in advance of any need to disturb or destroy any of the monuments of the site. Contractor must receive approval for such destruction or disturbance from Owner and Engineer prior to conducting the work.
- H. Only a professional land surveyor registered in the State of California will be permitted to perform surveying to reset or replace destroyed monuments. The professional land surveyor shall follow all rules, regulations, provisions, and laws of the State of California, as applicable for such work.
- I. The cost of replacement of monuments destroyed or disturbed by Contractor will be the sole responsibility of Contractor and be at no additional cost to Owner.

END OF SECTION 02 21 00

SECTION 02 41 00
SITE DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Furnishing all labor, materials, and equipment necessary for demolition, dismantling, cutting, and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:
 - a. Protecting existing work to remain.
 - b. Hazardous material identification and removal.
 - c. Utility service and termination.
 - d. Removing debris and equipment.
 - e. Removal of items indicated on Drawings.
 - f. Landscape and sprinkler demolition and reinstall.
 - g. Disposal of material.
- B. Related Sections:
 - 1. Section 01 50 00: Temporary Facilities and Controls.
 - 2. Section 31 20 00: Earthwork.
 - 3. Section 33 00 00: Utilities.
- C. Regulatory Requirements:
 - 1. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.
 - 2. Coordinate clearing work with utility companies.
 - 3. Maintain emergency access ways at all times.
 - 4. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.3 SUBMITTALS

- A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.
- B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during Work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
- B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

3.2 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, Contractor shall be solely and completely responsible for working conditions at the jobsite, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Safety precautions prevent damage to existing elements identified to remain or to be salvaged and prevent injury to the public and workmen engaged onsite. Demolish roofs, walls, and other building elements in such a manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate onsite. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends:
 - 1. Protect existing items that are not indicated to be altered. Protect utilities designated to remain from damage.
 - 2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on Drawings.
 - 3. Protect bench marks from damage or displacement.
- D. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.
- E. Fire Safety: Contractor shall conform to Chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition," at all times during the construction process. A copy of this chapter can be provided.
- F. Any construction review of Contractor's performance conducted by the geotechnical Engineer is not intended to include review of the adequacy of Contractor's safety measures in, on, or near the construction site.
- G. Surface Drainage: Provide for surface drainage during period of construction in a manner to avoid creating nuisance to adjacent areas. Contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of Work, regardless of cause, source, or nature of water.
- H. Adjacent streets and sidewalks shall be kept free of mud, dirt, or similar nuisances resulting from earthwork operations.
- I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

3.3 EXAMINATION

- A. Examine conditions of work in place before beginning Work; report defects.
- B. Report existence of hazardous materials or unsafe structural conditions.

3.4 PREPARATION

- A. Scheduling:
 - 1. General: Coordinate and schedule demolition work as required by Owner and as necessary to facilitate construction progress.
- B. Hazardous Materials:
 - 1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
 - 2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact Owner. Do not proceed with demolition until directed by Owner.
- C. Utility and Service Termination:
 - 1. Locate and identify existing utility, service, and irrigation system components affected by Work of this Contract. Review existing record Drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
 - 2. Prior to beginning any demolition, properly disconnect all water, gas, and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
 - 3. Prior to demolition or disconnect, obtain Owner's approval that such system does not impact facilities or systems beyond the extent of this Contract.
 - 4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project record documents.
- D. Verify that existing plant life and features designated to remain are tagged or identified.
 - 1. Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by Owner and all protective measures are in place.
- E. Coordinate the time and duration of all system disconnects with Owner.

3.5 DEMOLITION

- A. General Requirements:
 - 1. Clear areas required for access to site and execution of Work, including pavement, structures, foundations, vegetation, trash, and debris.
 - 2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
 - 3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
 - 4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
 - 5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.

- B. Fixture and Equipment Removal:
 - 1. Remove existing fixtures and equipment as identified and shown on Drawings and required by Architect.
 - 2. Verify all service connections to fixtures and equipment designated for removal have been properly disconnected.
 - 3. Remove all conductors from conduit at all abandoned circuits.

3.6 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

- A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts, and similar components:
 - 1. Review all Contract Documents showing crossing paths and potential points of interference.
 - 2. Pot-hole or determine by other means the accurate depth and location of such utilities.
 - 3. Incorporate all costs required to complete work under this Contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this Contract.
 - 4. No additional cost to Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on Contract Drawings or can be reasonably inferred from surface conditions or components.
- B. Remove all conductors from conduit at all abandoned electrical circuits.
- C. Seal off ends of all piping, drains, and other components as directed by Architect and serving utility.
- D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components:
 - 1. Re-circuit all electrical as required.
 - 2. Re-circuit all landscape irrigation valving and control systems as required.
 - 3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
 - 4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets, and piping. Fine grade to maintain proper drainage flow pattern to drains.
- E. Demolish structure in an orderly and careful manner:
 - 1. Use of explosives prohibited.

3.7 SITE PAVEMENT REMOVAL

- A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings:
 - 1. Remove all paving by saw-cutting.
 - 2. Remove concrete paving and curbing at locations shown on Drawings. Locate closest adjacent expansion or weakened plane joint to define start of removal or saw-cutting.
- B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings:
 - 1. Remove all paving by saw-cutting.
 - 2. Remove paving assembly as required to expose subgrade.

3.8 LANDSCAPE AND IRRIGATION SYSTEMS DEMOLITION AND RENOVATION

- A. Clearing, Grubbing, and Planting Demolition:

1. Where referenced in drawings, remove grass and grass roots to a minimum depth of two inches (2") below existing grade.
2. Remove all shrubs, plants, and other vegetation within the area of the work unless designated to remain. Grub and remove all roots of all vegetation to a depth of 24 inches below existing grade.
3. Remove only those trees that are specifically designated for removal, or as shown on the Drawings, within the construction area. Remove all stumps. Remove root ball and root systems larger than one inch (1") in diameter to a depth of two feet (2') below existing or finished grades, whichever is lower, and a minimum of five feet (5') beyond the edge of paving, structure, wall, or walkway.
4. Hand cut existing tree roots over one inch (1") in diameter as necessary for trenching or other new construction. Apply multiple coats of emulsified asphalt sealant especially made for horticultural use on cut or damaged plant tissues to cut faces and adjacent surfaces. Cover exposed roots with wet burlap to prevent roots from dying out until backfilling is complete.
5. Disking and mixing of vegetation, trash, debris, and other deleterious materials with surface soils prior to grading is not permitted.
6. Remove all buried debris, organic material, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
7. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with fill material in compliance with Section 31 00 00: Earthwork.
8. Selected equipment of such sizes and capacities that the existing environment is disturbed as little as possible, and to afford ease of mobility within limited and relatively confined work areas. Make every effort to preserve the topography in its natural state.
9. Keep drains, catch basins, surface drainage courses, and related drainage system components clear of debris and construction materials.
10. Remove irrigation piping and appurtenances as necessary within area of work, unless noted otherwise to remain. Replace irrigation piping and appurtenances to irrigate new and/or existing landscaping. Contractor shall be responsible for temporary landscape irrigation until such time that irrigation system is restored and operational.

3.9 DISPOSAL

- A. Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.
- B. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.
- C. It is required that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).
- D. Burning and Burying of Materials: **Not allowed.**
- E. Haul Routes:
 1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
 2. Keep streets free of mud, rubbish, etc. Assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.
- F. Remove demolished materials and debris from site on a daily basis.

3.10 CLEANING

- A. Upon completion of work of this Section, promptly remove from the working area all scraps

and debris.

- B. Clean excess material from the surface of all remaining paved surfaces and utility structures.
- C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 02 41 00

SECTION 02 41 10
DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Furnishing all labor, materials, and equipment necessary for demolition, dismantling, cutting, and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:
 - a. Protecting existing work to remain.
 - b. Hazardous material identification and removal.
 - c. Utility service and termination.
 - d. Removing debris and equipment.
 - e. Removal of items indicated on Drawings – Including buildings and their foundations and underground pipes, conduits, wire and other miscellaneous items.
 - f. Landscape and sprinkler demolition and reinstall.
 - g. Disposal of material.
- B. Related Sections:
 - 1. Section 01 50 00: Temporary Facilities and Controls.
 - 2. Section 01 57 13: Erosion control
 - 3. Section 31 00 00: Earthwork.
 - 4. Section 33 00 00: Utilities.
- C. Regulatory Requirements:
 - 1. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.
 - 2. Coordinate clearing work with utility companies.
 - 3. Maintain emergency access ways at all times.
 - 4. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.3 SUBMITTALS:

- A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.
- B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

1.4 EXISTING CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations

subsequent to discovery of such unknown active utilities.

- B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during Work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
- B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

3.2 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, Contractor shall be solely and completely responsible for working conditions at the jobsite, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Safety precautions prevent damage to existing elements identified to remain or to be salvaged and prevent injury to the public and workmen engaged onsite. Demolish roofs, walls, and other building elements in such a manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate onsite. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends:
 - 1. Protect existing items that are not indicated to be altered. Protect utilities designated to remain from damage.
 - 2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on Drawings.
 - 3. Protect bench marks from damage or displacement.
- D. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.
- E. Fire Safety: Contractor shall conform to Chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition," at all times during the construction process. A copy of this chapter can be provided.
- F. Any construction review of Contractor's performance conducted by the geotechnical Engineer is not intended to include review of the adequacy of Contractor's safety measures

in, on, or near the construction site.

- G. Surface Drainage: Provide for surface drainage during period of construction in a manner to avoid creating nuisance to adjacent areas. Contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of Work, regardless of cause, source, or nature of water.
- H. Adjacent streets and sidewalks shall be kept free of mud, dirt, or similar nuisances resulting from earthwork operations.
- I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

3.3 EXAMINATION

- A. Examine conditions of work in place before beginning Work; report defects.
- B. Report existence of hazardous materials or unsafe structural conditions.

3.4 PREPARATION

- A. Scheduling:
 - 1. General: Coordinate and schedule demolition work as required by Owner and as necessary to facilitate construction progress.
- B. Hazardous Materials:
 - 1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
 - 2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact Owner. Do not proceed with demolition until directed by Owner.
- C. Utility and Service Termination:
 - 1. Locate and identify existing utility, service, and irrigation system components affected by Work of this Contract. Review existing record Drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
 - 2. Prior to beginning any demolition, properly disconnect all water, gas, and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
 - 3. Prior to demolition or disconnect, obtain Owner's approval that such system does not impact facilities or systems beyond the extent of this Contract.
 - 4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project record documents.
- D. Verify that existing plant life and features designated to remain are tagged or identified.
 - 1. Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by Owner and all protective measures are in place.
- E. Coordinate the time and duration of all system disconnects with Owner.

3.5 DEMOLITION

- A. General Requirements:
 - 1. Clear areas required for access to site and execution of Work, including pavement, structures, foundations, vegetation, trash, and debris.
 - 2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
 - 3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
 - 4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
 - 5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.
- B. Fixture and Equipment Removal:
 - 1. Remove existing fixtures and equipment as identified and shown on Drawings and required by Architect.
 - 2. Verify all service connections to fixtures and equipment designated for removal have been properly disconnected.
 - 3. Remove all conductors from conduit at all abandoned circuits.

3.6 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

- A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts, and similar components:
 - 1. Review all Contract Documents showing crossing paths and potential points of interference.
 - 2. Pot-hole or determine by other means the accurate depth and location of such utilities.
 - 3. Incorporate all costs required to complete work under this Contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this Contract.
 - 4. No additional cost to Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on Contract Drawings or can be reasonably inferred from surface conditions or components.
- B. Remove all conductors from conduit at all abandoned electrical circuits.
- C. Seal off ends of all piping, drains, and other components as directed by Architect and serving utility.
- D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components:
 - 1. Re-circuit all electrical as required.
 - 2. Re-circuit all landscape irrigation valving and control systems as required.
 - 3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
 - 4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets, and piping. Fine grade to maintain proper drainage flow pattern to drains.
- E. Demolish structure in an orderly and careful manner:
 - 1. Use of explosives prohibited.

3.7 SITE PAVEMENT REMOVAL

- A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings:
 - 1. Remove all paving by saw-cutting.
 - 2. Remove concrete paving and curbing at locations shown on Drawings. Locate closest adjacent expansion or weakened plane joint to define start of removal or saw-cutting.
- B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings:
 - 1. Remove all paving by saw-cutting.
 - 2. Remove paving assembly as required to expose subgrade.

3.8 LANDSCAPE AND IRRIGATION SYSTEMS DEMOLITION AND RENOVATION

- A. Clearing, Grubbing, and Planting Demolition:
 - 1. Remove grass and grass roots to a minimum depth of two inches (2") below existing grade.
 - 2. Remove all shrubs, plants, and other vegetation within the area of the work unless designated to remain. Grub and remove all roots of all vegetation to a depth of 24 inches below existing grade.
 - 3. Remove only those trees that are specifically designated for removal, or as shown on the Drawings, within the construction area. Remove all stumps. Remove root ball and root systems larger than one inch (1") in diameter to a depth of two feet (2') below existing or finished grades, whichever is lower, and a minimum of five feet (5') beyond the edge of paving, structure, wall, or walkway.
 - 4. Hand cut existing tree roots over one inch (1") in diameter as necessary for trenching or other new construction. Apply multiple coats of emulsified asphalt sealant especially made for horticultural use on cut or damaged plant tissues to cut faces and adjacent surfaces. Cover exposed roots with wet burlap to prevent roots from dying out until backfilling is complete.
 - 5. Disking and mixing of vegetation, trash, debris, and other deleterious materials with surface soils prior to grading is not permitted.
 - 6. Remove all buried debris, organic material, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
 - 7. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with fill material in compliance with Section 31 00 00: Earthwork.
 - 8. Selected equipment of such sizes and capacities that the existing environment is disturbed as little as possible, and to afford ease of mobility within limited and relatively confined work areas. Make every effort to preserve the topography in its natural state.
 - 9. Keep drains, catch basins, surface drainage courses, and related drainage system components clear of debris and construction materials.
 - 10. Remove irrigation piping and appurtenances as necessary within area of work, unless noted otherwise to remain. Replace irrigation piping and appurtenances to irrigate new and/or existing landscaping. Contractor shall be responsible for temporary landscape irrigation until such time that irrigation system is restored and operational.

3.9 DISPOSAL

- A. Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.
- B. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.
- C. It is required that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).

- D. Burning and Burying of Materials: **Not allowed.**
- E. Haul Routes:
 - 1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
 - 2. Keep streets free of mud, rubbish, etc. Assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.
- F. Remove demolished materials and debris from site on a daily basis.

3.10 CLEANING

- A. Upon completion of work of this Section, promptly remove from the working area all scraps and debris.
- B. Clean excess material from the surface of all remaining paved surfaces and utility structures.
- C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 02 41 00

SECTION 02 41 13
SELECTIVE SITE DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Furnishing all labor, materials, and equipment necessary for demolition, dismantling, cutting, and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:
 - a. Protecting existing work to remain.
 - b. Cleaning soiled materials that are to remain.
 - c. Disconnecting and capping utilities.
 - d. Removing debris and equipment.
 - e. Removal of items indicated on Drawings.
 - f. Salvageable items to be retained by Owner as indicated on Drawings and during the pre-construction job walk.
- B. Related Sections:
 - 1. Section 31 20 00: Earthwork.

1.3 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain Owner's property.
- B. Remove and Salvage: Items indicated to be removed and salvaged remain Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to location as directed by Owner's representative.
- C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse. Store and protect against damage. Reinstall items in locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by Owner's representative, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.
- E. Replace: Remove and legally dispose of existing item(s) indicated and install new like item(s) that conform to Project Specifications.

1.4 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. Applicable codes, ordinances, and regulations of local, municipal, state, and federal authorities having jurisdiction.
 - 2. Comply strictly to Rule 403 Fugitive Dust, Sacramento Air Quality Management

- District.
- 3. Obtain necessary permits and notices; post where required.
- 4. Comply with safety requirements of the local fire department.
- 5. Comply with ANSI A10.6.
- B. Notify affected utility companies before starting Work and comply with their requirements.
- C. Carefully perform demolition work by skilled workers experienced in building demolition procedures, using appropriate tools and equipment. Perform work, at all times, under the direct supervision of a supervisor approved by Owner's inspector.
- D. Coordinate demolition with other trades to ensure correct sequence, limits, and methods of proposed demolition. Schedule work to create least possible inconvenience to the public and to facility operations.
- E. Pre-Demolition:
 - 1. Conduct conference at Project site seven (7) days prior to scheduled installation:
 - a. Conference agenda shall include review and discussion of requirements of authorities having jurisdiction, instructions and requirements of serving utilities, sequencing and interface considerations, and Project conditions.
 - b. Conference shall be attended by supervisory and quality control personnel of Contractor and all subcontractors performing this and directly related work. Submit minutes of meeting to design builder's representative for Project record purposes.
- F. Ownership of Materials:
 - 1. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from the site with further disposition at Contractor's option.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Items scheduled for salvage by Owner shall be delivered to a location designated by Owner's authorized representative. Items shall be cleaned, packaged, and labeled for storage.
- B. Items scheduled for reuse shall be stored onsite and protected from damage, soiling, and theft.
- C. Follow legal requirement to hand expose to the point of no conflict 24 inches on either side of the underground facility, so its exact location is known before using power equipment.
- D. Note: If caught digging without a Dig Alert ticket, a fine of up to fifty thousand dollars (\$50,000.00) may be assessed per California government code 4216.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: The onsite shallow sands encountered in the borings are considered non-expansive and following proper processing should be suitable for backfilling purposes provided they are free of deleterious materials and oversize particles. Import materials may also be used for backfilling. The onsite or imported materials being used for backfilling should be non-expansive (EI less than 20), and should be in compliance with the specifications of the Project's soils report.

- B. Backfill and Native Fill Materials: The onsite soils may be reused as compacted engineered fill provided they comply with the requirements of satisfactory soil materials as described above.
- C. Borrow/Imported Fill Material: Soil excavated from site or imported conforming to requirements for fill material shall conform to Section 31 22 00: Grading.
- D. Engineered Fill: Satisfactory soil materials/borrow fill material, as described above, placed in lifts no greater than eight inches (8") thick (loose measurements) and each lift moisture conditioned. All engineered fill should be densified to a minimum relative compaction of 90 percent per ASTM D1557.
- E. Backfill Material for Trenches: The onsite soils have been determined to be suitable for being used for backfilling purposes in trenches. Utility trenches should be backfilled with granular materials and mechanically compacted to at least 90 percent of the maximum dry density of the soils.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Drawings may not indicate in detail all demolition work to be carried out. Carefully examine existing conditions to determine full extent of demolition required. All utilities, whether shown on Drawings or not, to be capped at the property line U.N.O.
- B. Repair damage due to demolition activities to existing improvements to remain at no additional cost to Owner. Repair or replace as directed by Owner's inspector.
- C. Take measures to avoid excessive damage from inadequate or improper means and methods, or improper shoring, bracing, or support. Repair or replace any resulting damage at no additional cost to Owner as directed by Owner's inspector.
- D. If conditions are encountered that vary from those indicated, notify Owner's inspector for instructions prior to proceeding. Owner assumes no responsibility for actual condition of structures to be demolished.
- E. Inform Owner immediately upon discovery of asbestos products, radioactive materials, toxic wastes, or other hazardous materials. Do not remove hazardous materials without Owner authorization.
- F. Adjacent roadways/passageways:
 - 1. Maintain fire department access through all phases of the Project.
 - 2. Obstruction of streets, walks, or other adjacent facilities will not be allowed.

3.2 DIG ALERT NOTIFICATION

- A. Before any excavation in or near the public right-of-way, Contractor must contact the Underground Service Alert or USA-North (Dig Alert) at 811 or 800-642-2444 for information on buried utilities and pipelines.
- B. Delineation of the proposed excavation site is mandatory. Mark the area to be excavated with water soluble or chalk based white paint on paved surfaces or with other suitable markings such as flags or stakes on unpaved areas.

- C. Call at least two (2) full working days prior to digging.
- D. If the members (utility companies) have facilities within the work area, they will mark them prior to the start of excavation; if not, they will provide notice of no conflict. A different color is used for each utility type (electricity is marked in red, gas in yellow, water in blue, sewer in green, telephone and cable TV in orange).

3.3 GENERAL

- A. Protection:
 - 1. Do not begin demolition until safety partitions, barricades, warning signs, and other forms of protection are installed.
 - 2. Provide safeguards, including warning signs, lights and barricades, for protection of occupants and the general public during demolition.
 - 3. Provide and maintain fire extinguishers. Comply with requirements of governing authorities.
 - 4. Maintain existing utilities that are to remain in service and protect from damage during operations.
- B. Safety: If at any time safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify Owner's inspector. Do not resume demolition until directed by Owner's inspector.
- C. Noise and Dust Abatement: Exercise all reasonable and necessary means to abate dust, dirt rising, and undue noise. Perform necessary sprinkling and wetting of construction site to allay dust as required by applicable codes and ordinances.
- D. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations. Do not create hazardous or objectionable conditions, such as flooding and pollution, when using water.
- E. Water for Dust Control: Contractor shall obtain and pay for all water required for dust control operations. This may include, but is not limited to, payment of deposits to utility for construction meter, and payment of all monthly service and water charges. Construction meter shall be in place throughout construction period unless alternative arrangements are made with the City of El Segundo Water Department to provide construction water for all purposes. Contractor shall be aware of water moratoriums and restrictions, and shall immediately advise Owner of effects on construction schedules.
- F. An eight-foot-high (8') chain link fence and gates shall be erected prior to any demolition operations at the construction limits perimeter. Coordinate the exact location with Owner.
- G. Debris Removal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.
- H. Progress Cleaning: Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.
- I. Where performing contracted scope of work requires coring of existing concrete, brick masonry, or CMU structures (including walls, floors, and sitework), Contractor shall obtain and document means of verifying existence and location of embedded steel reinforcing materials within said concrete, brick, and CMU assemblies. Contractor shall locate

reinforcement by means of noninvasive technology, such as X-ray photography, for the purposes of protecting said reinforcement in place and shall not damage any reinforcement materials (rebar, etc.) unless specifically detailed as such and approved by the authority having jurisdiction.

- J. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- K. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- L. Contractor shall provide temporary weather protection during interval between demolition and removal of existing construction, on exterior surfaces, and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
- M. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.
- N. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.
- O. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials if exposed; repaired surfaces shall match existing adjacent surface color finish and texture:
 - 1. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.
- P. Disposal: Promptly dispose of demolished materials; do not allow demolished materials to accumulate onsite.

3.4 PREPARATION

- A. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.
- B. Utilities:
 - 1. The Drawings do not purport to show all below-grade conditions and objects on the site. Contractor shall perform field investigations as necessary to establish location of underground utility services and other features affecting earthwork.
 - 2. Mark location of underground utilities on asphalt pavement with paint.
 - 3. Disconnect and cap utility services; comply with requirement of governing authorities.
 - 4. Contractor shall arrange and notify utility company in advance of date and time when service needs to be disconnected.
 - 5. Do not commence demolition operations until associated disconnections have been completed.
 - 6. Should utilities and other below-grade conditions be encountered that adversely affect the Work, discontinue affected Work and notify Owner's representative and Architect and request direction. Unforeseen conditions will be resolved in accordance with provisions of the General Conditions of the Contract.
 - 7. Should a utility line or structure be damaged, immediately notify the responsible utility company or agency and notify Owner's representative and Architect:
 - a. Repair or replace all damaged utility lines and structures as directed by the

- responsible utility company or agency.
- b. Repair or replacement of damaged utility lines and structures whose location or existence has been made known to Contractor shall be at no change in the Contract Time and Contract price.
- C. Structures to be demolished shall be inspected for hazardous materials; such materials shall be removed and disposed of before general demolition begins.
- D. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner's representative and authority having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner's representative and authority having jurisdiction.

3.5 EXPLOSIVES

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

3.6 DEMOLITION

- A. Demolition, General:
 - 1. With certain exceptions, Contractor shall raze, remove, and dispose of all buildings and foundations, structures, paving, fences, and other obstructions that lie wholly or partially within the construction limits identified on Drawings. The exceptions are utility-owned equipment and any other items the Owner/Documents may direct Contractor to leave intact or re-use onsite. Cease demolition immediately if adjacent structures appear to be in danger.
 - 2. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 3. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner's representative and authority having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
 - 4. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area:
 - a. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - b. Protect existing site improvements, appurtenances, and landscaping to remain.
 - c. Completely remove below-grade construction, including foundation walls and footings.
 - 5. Filling below-grade areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavement with soil materials according to requirements specified in Section 31 22 00: Grading.
 - 6. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.
 - 7. Unless otherwise indicated on the Plans, remove all demolished material from the site and dispose of at approved disposal sites. Comply with all requirements for recycling of demolished material as called for in Division 01 of this Specification. Contractor shall obtain necessary permits for the transportation of material from the site.

3.7 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT AND SERVICES

- A. Remove existing plumbing and electrical equipment fixtures and services not indicated for reuse and not necessary for completion of Work. Remove abandoned lines and cap unused portions of existing lines. Contractor is responsible for completely surveying the site and

locating all existing utilities, above and below ground, before contracting to perform the work.

- B. Asbestos – Cement (A-C) Pipe Removal and Disposal: The Plans for the Project may indicate that existing asbestos-cement pipe is to be removed from the ground. Where so indicated, Contractor shall excavate with care, expose the pipeline, and remove the A-C pipe to the nearest joint. Should the Plans not call out the removal of the A-C pipe and A-C pipe is encountered, Contractor shall obtain approval from Owner as to whether or not the A-C pipe is to be removed or can be left in place. Cutting of the pipe shall only be done if there is no other way to expose the length of pipe to the nearest joint that be separated and Owner approves the cutting of the pipe. Cutting of the pipe shall be done with a mechanical saw with a pressure water source to dampen the pipe and the dust from the cutting. To remove a coupling, the coupling may have to be broken in the trench. The pipe once removed from the trench may be broken for handling. The breaking shall be done within a plastic bagging or sheeting material to minimize the release of asbestos fibers into the atmosphere. Once removed and broken, if necessary, the A-C material shall be bagged and disposed of legally with Owner being given a copy of all Contractor paperwork as to the legal disposal of the material. If the A-C pipe section(s) are removed intact, the pipe can be removed by Contractor from the Project site and become the property and responsibility of Contractor.

3.8 CLEANING

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

3.9 RESTORATION

- A. Restoration of Site Finishes:
1. Concrete paving: Where it is necessary to excavate a trench across, make a cut in concrete paved areas, cut concrete with cutting saw, full depth of paving.
 2. Bituminous paving: Where it is necessary to excavate a trench across, make a cut in bituminous paved areas, either first score paving with a concrete cutting saw, in neat straight lines, prior to removing paving, or make straight cuts with pneumatic spade.
 3. Restoration of paving: Restore all paved areas to their original condition using material of like type and quality as the removed paving. Paving in public ways shall conform to applicable requirements of authorities having jurisdiction. Repaired surfaces shall match existing adjacent paving except minimum depth shall be 3-1/2 inches where existing paving is less than 3-1/2 inches.
 4. Restoration of landscape planting: Restore soil and plant materials to match original condition, including additional topsoil, topsoil grading and preparation, new plant materials, and plant maintenance during establishment period.

3.10 MAINTENANCE

- A. Install and maintain all erosion control devices, including sandbag and gravel bag dikes, silt fences, de-silting basins, inlet barricades, vehicle wash traps, and other features called for in the Storm Water Pollution Prevention Plan and Temporary Erosion Control Plans.

3.11 CLEAN-UP/DISPOSAL

- A. Coordinate building access with the Owner's inspector. Review and schedule waste storage and removal, include truck access to site.
- B. Debris shall be dampened by fog water spray prior to transporting by truck.

- C. Debris pick-up area shall be kept broom-clean and shall be washed daily with clean water.
- D. Remove waste and debris other than items to be salvaged. Turn over salvaged items to Owner, or store and protect for reuse where scheduled. Continuously clean-up and remove items as demolition work progresses. Do not allow waste and debris to accumulate in building or onsite.

END OF SECTION 02 41 13

SECTION 02 82 00
ASBESTOS REMEDIATION

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 requirements including but not limited to:
 - 1. Asbestos material abatement and disposal.
 - 2. Accessories necessary for complete removal.
- B. Related Sections:
 - 1. Section 00 73 56: Hazardous Materials Procedures and Requirements.

1.3 SUBMITTAL

- A. Submit copy of the signed waste manifests indicating the place, time, and exact quantity of asbestos received by an approved landfill.

1.4 QUALITY ASSURANCE

- A. Qualifications: Entity having minimum five (5) years' documented experience, holding required current licenses for the removal, transport, disposal, and related activities relative to the work, having the required personal protective equipment for abatement operations, with current liability insurance, and who employs workers fully trained and knowledgeable in the removal of hazardous materials.
- B. Stop Asbestos Removal:
 - 1. If a verbal or written Stop Asbestos Removal Order is given, immediately stop asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed Asbestos Contained Material (ACM).
 - 2. Do not resume asbestos removal activity until authorized to do so in writing from District.
 - 3. A stop asbestos removal order may be issued at any time by the District if it is determined that abatement conditions/activities are not within regulatory requirements or that an imminent hazard exists to human health or the environment.
 - 4. Work stoppage will continue until conditions have been corrected.

PART 2 MATERIALS (NOT USED)

PART 3 EXECUTION

3.1 REMEDIATION

- A. Owner has conducted an asbestos survey and has determined that asbestos may be present in areas where Work will be performed. The survey is made available for review:
 - 1. As part of the Work, Owner requires asbestos removal to be performed under the

- construction Contract.
 - 2. Asbestos may be present in vinyl tile under architectural woodwork or covered by, but not encapsulated, carpet materials and other types of flooring.
 - 3. Asbestos may be present in the ductwork above the ceiling panels.
 - 4. If asbestos is found, stop work in the area and engage an asbestos removal firm to remediate the asbestos from the area. Do not resume work in the affected areas until the abatement is complete and authorization to proceed with work in the affected areas is given. Work in areas not affected by asbestos may continue.
- B. Assume responsibility and liability for compliance with applicable federal, state, and local regulations related to the asbestos abatement work:
- 1. Provide and maintain training, accreditations, medical exams, medical records, and personal protective equipment (PPE) including respiratory protection and respirator fit testing, as required by applicable federal, state, and local regulations.
 - 2. Post required notices prior to the commencement of the work.
 - 3. Restrict access to containment areas to authorized, trained, and protected personnel.
 - 4. Prepare and post an emergency plan in clean room and equipment room of the decontamination unit.
 - 5. Do not permit workers to eat, drink, smoke, chew gum or tobacco, or break the protection of the respiratory protection system in the work area.
- C. Entering and Existing Procedures: Establish procedures for entering and existing containment area. Provide personnel decontamination unit with disposable coveralls, head covers, and clean respirators. Provide shower room between personnel decontamination area and equipment room.
- D. Decontamination Procedures: Establish and ensure that procedures for decontamination upon leaving containment area are in accordance with federal and state regulations.
- E. Provide negative pressure filtration systems to complete air exchange four (4) times per hour. Provide standby system in the event of a machine failure or emergency:
- 1. Continuously monitor and record the pressure differential between the work area and the building outside of the work area.
- F. Prepare the Affected Area: Remove furnishings and materials to the extent necessary to remediate the asbestos.
- G. Containment of Areas:
- 1. Provide a secure containment work area in accordance with federal and state regulations. Avoid damage to existing partitions and ceilings scheduled to remain to the extent possible:
 - a. Establish critical barriers over each opening into the work area.
 - b. Close out vents and air ducts to prevent particulates from entering the HVAC system.
- H. Debris:
- 1. Place contaminated debris in a designated location within the containment area:
 - a. Place debris in minimum six (6) mil poly bags before removing from contaminated areas. Pass clean or decontaminated bags through a double six (6) mil flap doorway into another bag or fiber drum. Remove to disposal dumpster/gondola/vehicle. Do not permit unprotected personnel to come in contact with contaminated bags.
 - b. Remove and dispose of contaminated debris legally.
- I. Testing: Perform required tests and inspections upon completion of the work. Collect air

samples and analyze in accordance with regulations. Upon satisfactory conclusion of testing, remove critical barriers.

- J. After thorough decontamination, complete asbestos abatement work upon meeting the regulated area clearance criteria and fulfilling the following:
 - 1. Remove equipment, materials, and debris from the Project area.
 - 2. Package and dispose of asbestos waste, as required.
 - 3. Repair or replace all interior finishes damaged during the abatement work.
 - 4. Fulfill other Project closeout requirements as specified elsewhere in this Specification.

3.2 CERTIFICATE OF COMPLETION BY CONTRACTOR

- A. Submit a signed *Certificate of Completion* at the completion of the abatement and decontamination of the regulated area.

END OF SECTION 02 82 00

SECTION 02 83 00
LEAD REMEDIATION

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 requirements including but not limited to:
 - 1. Recognition of lead-based material and its definition.
 - 2. Federal and state requirement reference.
 - 3. Contractor's Liability.
 - 4. Contractor's Acknowledgment.
- B. Related Sections:
 - 1. Section 00 73 56: Hazardous Materials Procedures and Requirements.
- C. Lead as a Health Hazard:
 - 1. Lead poisoning is recognized as a serious environmental health hazard facing children today. Even at low levels of exposure - much lower than previously believed - lead can impair the development of a child's central nervous system, causing learning disabilities and leading to serious behavioral problems. Lead enters the environment as tiny lead particles and lead dust disbursts when paint chips or chalks peels or wears away over time, or is otherwise disturbed. Ingestion of lead dust is the most common pathway of childhood poisoning; lead dust gets on a child's hands and toys and then into a child's mouth through common hand-to-mouth activity. Exposures may result from construction or remodeling activities that disturb lead paint, from ordinary wear and tear of windows and doors, or from friction on other surfaces.
 - 2. Ordinary construction and renovation or repainting activities carried out without lead-safe work practices can disturb lead-based paint and create significant hazards. Improper removal practices, such as dry scraping, sanding, or water blasting painted surfaces, are likely to generate high volumes of lead dust.
 - 3. Because Contractor and his employees will be providing services for the District, and because Contractor's work may disturb lead-containing building materials, CONTRACTOR IS HEREBY NOTIFIED of the potential presence of lead-containing materials located within certain buildings utilized by the District. All school buildings built prior to 1978 are presumed to contain some lead-based paint until sampling proves otherwise.
 - 4. Refer to "Asbestos and Lead-Based Paint Survey Report – Appendix A" in this Project manual.
 - 5. Education Code section 32240 et seq. is known as the Lead-Safe Schools Protection Act. Under this act, the Department of Health Services is to conduct a sample survey of schools in the State of California for the purpose of developing risk factors to predict lead contamination in public schools (Ed. Code, § 32241).
 - 6. Any school that undertakes any action to abate existing risk factors for lead is required to utilize trained and state-certified contractors, inspectors, and workers (Ed. Code, § 32243, sub. [b]). Moreover, lead-based paint, lead plumbing, solders, or other potential sources of lead contamination shall not be utilized in the construction of any new school facility, or the modernization or renovation of any existing school facility (Ed.

- Code, § 32244).
7. Both the Federal Occupational Safety and Health Administration (Fed/OSHA) and the California Division of Occupational Safety and Health (Cal/OSHA) have implemented safety orders applicable to all construction work where a contractor's employee may be occupationally exposed to lead.
 8. The OSHA Regulations contain specific and detailed requirements imposed on contractors subject to that regulation. The OSHA Regulations define construction work as work for construction, alteration, and/or repair, including painting and decorating. It includes, but is not limited to, the following:
 - a. Demolition or salvage of structures where lead or materials containing lead are present.
 - b. Removal or encapsulation of materials containing lead.
 - c. New construction, alteration, repair, or renovation of structures, substrates, or portions thereof that contain lead, or materials containing lead.
 - d. Installation of products containing lead.
 - e. Lead contamination/emergency cleanup.
 - f. Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed.
 - g. Maintenance operations associated with the construction activities described in Section 01 78 23: Operation and Maintenance Data, or within this Section.
 9. Because it is assumed by the District that a portion of painted surfaces (interior as well as exterior) within the District contain some level of lead, it is imperative that Contractor, workers, and subcontractors fully and adequately comply with all applicable laws, rules, and regulations governing lead-based materials, including title 8, California Code of Regulations, section 1532.1.
 10. Contractor shall notify the District if any Work may result in the disturbance of lead-containing building materials. Any and all Work that may result in the disturbance of lead-containing building materials shall be coordinated through the District. A signed copy of this Certification shall be on file prior to beginning Work on the Project, along with all current insurance certificates.
- D. Renovation, Repair, and Painting Rule:
1. Toxic Substance Control Act Section 402(a):
 - a. The EPA requires lead safe work practices to reduce exposure to lead hazards created by renovation, repair, and painting activities that disturb lead-based paint. Pursuant to the Renovation, Repair and Painting Rule (RRP), renovations in homes, childcare facilities, and schools built prior to 1978 must be conducted by certified renovations firms, using renovators with training by a EPA-accredited training provider, and fully and adequately complying with all applicable laws, rules, and regulations governing lead-based materials, including those rules and regulations appearing within title 40 of the Code of Federal Regulations as part 745 (40 CFR 745).
 - b. The RRP requirements apply to all contractors who disturb lead-based paint in a six (6) square foot or greater area indoors or a 20 square foot or greater area outdoors. If a DPH-certified inspector or risk assessor determines that a structure constructed before 1978 is lead-free, the federal certification is not required for anyone working on that particular building.

1.3 SUBMITTAL

- A. Contractors Acknowledgment (bottom of Section).
- B. Submit copy of the signed waste manifests indicating the place, time, and exact quantity of material received by an approved landfill.

1.4 CONTRACTOR'S LIABILITY

- A. If Contractor fails to comply with any applicable laws, rules, or regulations, and that failure results in a site or worker contamination, Contractor will be held solely responsible for all costs involved in any required corrective actions, and shall defend, indemnify, and hold harmless the District, pursuant to the indemnification provisions of the Contract, for all damages and other claims arising therefrom.
- B. If lead disturbance is anticipated in the Work, only persons with appropriate accreditation, registrations, licenses, and training shall conduct this Work.
- C. It shall be the responsibility of Contractor to properly dispose of any and all waste products, including, but not limited to, paint chips, any collected residue, or any other visual material that may occur from the prepping of any painted surface. It will be the responsibility of Contractor to provide the proper disposal of any hazardous waste by a certified hazardous waste hauler. This company shall be registered with the Department of Transportation (DOT) and shall be able to issue a current manifest number upon transporting any hazardous material from any Project site.
- D. Contractor shall provide the District with any sample results prior to beginning Work, during the Work, and after the completion of the Work. The District may request to examine, prior to the commencement of the Work, the lead training records of each employee of Contractor.

SECTION CONTINUES ON NEXT PAGE

CONTRACTOR HEREBY ACKNOWLEDGES UNDER PENALTY OF PERJURY THAT IT:

1. HAS RECEIVED NOTIFICATION OF POTENTIAL LEAD-BASED MATERIALS ON OWNER'S PROPERTY;
2. IS KNOWLEDGEABLE REGARDING AND WILL COMPLY WITH ALL APPLICABLE LAWS, RULES, AND REGULATIONS GOVERNING WORK WITH, AND DISPOSAL OF, LEAD.

THE UNDERSIGNED WARRANTS THAT HE/SHE HAS THE AUTHORITY TO SIGN ON BEHALF OF AND BIND CONTRACTOR. THE DISTRICT MAY REQUIRE PROOF OF SUCH AUTHORITY.

Date: _____

Proper Name of Contractor: _____

Signature: _____

Print Name: _____

Title: _____

PROJECT/CONTRACT NO.: _____ (Project or Contract)

between Madera Unified School District (District) and _____

(Contractor or Bidder).

This certification provides notice to Contractor that:

1. Contractor's work may disturb lead-containing building materials.
2. Contractor shall notify the District if any work may result in the disturbance of lead-containing building materials.
3. Contractor shall comply with the Renovation, Repair, and Painting Rule, if lead-based paint is disturbed in a six (6) square-foot or greater area indoors or a 20-square-foot or greater area outdoors.

END OF SECTION 02 83 00

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section is related to concrete forming and accessories and includes:
 - 1. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
 - 2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.
 - 3. Openings for other work.
 - 4. Form accessories.
 - 5. Form stripping.
- B. Related Sections:
 - 1. Section 03 20 00: Concrete Reinforcing.
 - 2. Section 03 30 00: Cast-in-Place Concrete.
 - 3. Section 05 12 00: Structural Steel Framing.
- C. Reference Standards:
 - 1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 Specifications for Structural Concrete.
 - 3. ACI 318-14 Building Code Requirements for Structural Concrete and Commentary.
 - 4. ACI 347 Guide to Formwork for Concrete.
 - 5. National Institute of Standards and Technology - PS 1 Structural Plywood.
 - 6. 2022 California Building Code, Chapter 19A.
 - 7. APA American Plywood Association Design and Construction Guide.
 - 8. Local AQMD - Air Quality Management District.

1.3 SUBMITTALS

- A. See Section 01 33 00: Submittal Procedures.
- B. Product Data: Provide data on void form materials and installation requirements.
- C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties. Review and approval will not include form strength and adequacy.
- D. Keep an accurate record of the dates of removal of forms, form shores and reshores, and furnish copies to the SEOR.

1.4 QUALITY ASSURANCE

- A. Comply with the pertinent provisions of Section 01 40 00: Quality Requirements.
- B. Construct forms according to ACI 347, "Guide to Formwork for Concrete," and conforming to tolerances of ACI 117, "Standard Specifications for Tolerances for Concrete Construction

and Materials."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Section 01 60 00: Product Requirements, delivering materials in a timely manner to ensure uninterrupted progress.
- 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 to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

2.2 WOOD FORM MATERIALS

- A. Softwood Plywood: PS 1, B-B Medium or High Density Concrete Form Overlay, Class I, grade marked, not mill oiled.
- B. Lumber: DF species; WCLIB Construction grade or better, WWPA No. 1 grade or better; with grade stamp clearly visible.

2.3 REMOVABLE PREFABRICATED FORMS

- A. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; two inches (2") thick.

2.4 FORMWORK ACCESSORIES

- A. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, or equal, not leaving metal within 1-1/2 inches of concrete surface.
- B. Form Release Agent:
 - 1. Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bug holes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied:
 - a. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable oil-based compound.
 - b. Do not use materials containing diesel oil or petroleum-based compounds.
 - c. VOC content: In compliance with applicable local, state, and federal regulations.
- C. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00: Structural Steel Framing.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete. Sides of all footings and grade beams shall be formed, unless the member detail provides at least three inches (3") clear cover to reinforcement and indicates the member is cast against earth. Remove formwork prior to backfilling operations.

3.3 ERECTION - FORMWORK

- A. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Rigidly construct forms to prevent mortar leakage, sagging, displacement, or bulging between studs. Use clean, sound, approved form material, coated with specified materials only, not oil. Provide backing on all plywood joints.
- C. Coat forms with the specified resin coating, not form oil. Construct forms to exact shapes, sizes, lines, and dimensions required to obtain level, plumb, and straight surfaces. Provide openings, offsets, keys, reglets, anchorages, recesses, moldings, chamfers, blocking, screeds, drips, bulkheads, and all other required features. Make forms easily removable without hammering or prying against concrete. Space forms apart with metal spreaders. Construct forms to accurate alignment, locations, and grades, and provide against sagging, leakage of concrete mortar, or displacement occurring during and after placing of concrete. Coordinate installation of inserts and anchors in forms according to shop drawings and requirements for Work of other Sections.
- D. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- E. Corners and angles: Provide 3/4-inch by 3/4-inch beveled chamfer strips for all exposed concrete corners and angles square unless indicated otherwise.
- F. Reglets and Rebates: Form required reglets and rebates to receive frames, flashing, and other equipment. Obtain required dimensions, details, and precise positions for Work to be installed under other Sections and form concrete accordingly.
- G. Form Joints: Align joints and make watertight. Keep form joints to a minimum. Fill joints to produce smooth surfaces, intersections, and arises. Use polymer foam or equivalent fillers at joints and where forms abut or overlap existing concrete to prevent leakage of mortar.
- H. Recesses, Drips, and Profiles: Provide smooth milled wood or pre-formed rubber or plastic shapes of types shown and required.
- I. Cleanouts and Cleaning: Provide temporary openings in all wall forms and other vertical forms for cleaning and inspection. Clean forms and surfaces to receive concrete prior to placing.
- J. Re-Use: Clean and recondition form material before re-use.

3.4 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will 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.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. All necessary pipe sleeves, anchors, or other required inserts shall be accurately installed as part of the work of other Sections, according to Section 03 30 00: Cast-In-Place Concrete, for submittal requirements related to this scope.
- B. Obtain approval before framing openings in structural members that are not indicated on Drawings.
- C. Provide formed openings where required for items to be embedded in passing through concrete work.
- D. Locate and set in place items that will be cast directly into concrete.
- E. Conduits or Pipes:
 - 1. Locate so as not to reduce strength of the concrete.
 - 2. Do not place pipes, other than conduits, in a slab 4-1/2 inches thick or less in any case. Conduit buried in a concrete slab shall not have an outside dimension greater than 1/3 the slab thickness nor be placed below the bottom reinforcing or over the top reinforcing.
 - 3. Sleeves: Pipe sleeves may pass through the slab or walls if not exposed to rusting or other deterioration and are of uncounted or galvanized iron or steel. Provide sleeves of diameter large enough to pass any hub or coupling on pipe, including any insulation.
 - 4. Conduits may be embedded in walls only if the outside diameter does not exceed 1/3 the wall thickness, are spaced no closer than three (3) diameters on centers, and not impair the strength of the structure.
- F. Coordinate with work of other Sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- G. Install accessories in accordance with manufacturer's instructions so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- H. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.
- I. 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.
- J. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fit so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.

3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.
- B. Deflection: Limit deflection of forming surfaces from concrete pressure to L/240.
- C. Finish Lines:
 - 1. Position formwork to maintain hardened concrete finish lines within following permissible deviations:
 - a. Variation from plumb:

In 10'-0"	1/4 inch
In any story or 20'-0"	3/8 inch
In 40'-0" or more	3/4 inch
 - b. Variation from level or grades indicated:

In 10'-0"	1/4 inch
In any story or 20'-0"	3/8 inch
In 40'-0" or more	3/4 inch
 - c. Cross-sectional dimensions:

Minus	1/4 inch
Plus	1/2 inch

3.8 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.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and all superimposed loads as determined by testing field cured cylinders, but not sooner than specified in ACI 347. Load supporting forms may be removed when concrete has attained 75 percent of required 28-day compressive strength, but no sooner than three (3) days, provided construction is reshored. Vertical formwork for cast-in-place concrete walls may be removed no sooner than one (1) day following concrete placement, provided that Contractor can demonstrate that no sloughing or sagging of concrete will occur:
 - 1. Reshore structural members as specified per ACI 347.
 - 2. Remove formwork progressively so unbalanced loads are not imposed on the structure.
 - 3. Avoid damage to concrete surfaces during removal.
 - 4. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.

END OF SECTION 03 10 00

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section is related to concrete reinforcement and includes:
 - 1. Reinforcing steel for cast-in-place concrete foundations.
 - 2. Reinforcing steel for cast-in-place concrete slabs-on-grade.
 - 3. Supports and accessories for steel reinforcement.
- B. Related Sections:
 - 1. Section 03 30 00: Cast-in-Place Concrete.
 - 2. Section 05 12 00: Structural Steel Framing.
- C. Reference Standards:
 - 1. ACI 301 Specifications for Structural Concrete.
 - 2. ACI 318 Building Code Requirements for Structural Concrete and Commentary.
 - 3. ACI SP-066 ACI Detailing Manual.
 - 4. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 5. ASTM A706/A706M Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
 - 6. ASTM A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 - 7. ASTM D3963/D3963M Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
 - 8. AWS D1.4 Structural Welding Code - Reinforcing Steel.
 - 9. CRSI Concrete Reinforcing Steel Institute Manual of Standard Practice.
 - 10. CRSI Concrete Reinforcing Steel Institute Placing Reinforcing Bars.

1.3 SUBMITTALS

- A. See Section 01 33 00: Submittal Procedures.
- B. Shop Drawings:
 - 1. Comply with requirements of ACI SP-066. Include the following:
 - a. Complete bar layout.
 - b. Representative sections.
 - c. Details for congested conditions.
 - d. Proposed layout where vertical and horizontal bars intersect.
 - e. Bar schedules.
 - f. Typical bending diagrams and offsets.
 - g. Shapes of bent bars.
 - h. Spacing of bars.
 - i. Splice lengths and locations.
- C. Where welding is proposed:

1. Detail welding to conform to AWS D1.4.
 2. Submit copies of welding operator's certificate.
 3. Weld procedure specifications (WPS):
 - a. All WPS's shall be submitted to the Structural Engineer of Record (SEOR) for review and approval prior to use.
 - b. For WPS's that have been qualified by test, the supporting Procedure Qualification Record (PQR) shall be submitted to the SEOR for review and approval.
 - c. Included shall be WPS for repair welds.
- D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

- A. Comply with the pertinent provisions of Section 01 40 00: Quality Requirements.
- B. Perform work of this Section in accordance with ACI 301.
- C. Welders' Certificates: Submit certifications for welders employed on the Project, verifying AWS qualification within the previous 12 months.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Section 01 60 00: Product Requirements, delivering materials in a timely manner to ensure uninterrupted progress.
- B. Bundle bars, tag with identification, and transport and store so as not to damage any material. Use metal tags indicating size, length, and other marking shown on placement drawings. Maintain tags after bundles are broken.
- C. Avoid exposure to dirt, moisture, or conditions harmful to reinforcement.
- D. Extra Material:
 1. Provide an allowance of an additional ten percent (10%) of the total reinforced steel tonnage in addition to the quantities shown on the Drawings. This additional steel shall be installed in sizes and locations as directed by the structural Engineer.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel:
 1. ASTM A615/A615M, Grade 60 (60,000 psi):
 - a. Deformed billet-steel bars.
 - b. Unfinished.
 - c. Only to be used for conditions where bars will not be welded.
- B. Reinforcing Steel:
 1. ASTM A706/A706M, Grade 60 (60,000 psi) deformed low-alloy steel bars:
 - a. Unfinished.
 - b. Used in all cases where welding of bars is required.
- C. Reinforcement Accessories:
 1. Tie wire: ASTM A1064, annealed copper bearing steel, minimum 16 gage, 0.0508 inch.
 2. Chairs, bolsters, bar supports, spacers:

- a. Sized and shaped for adequate support of reinforcement during concrete placement. Standard manufactured products shall conform to the Concrete Reinforcing Institute Manual of Standard Practice, latest edition.
- 3. Use dense precast concrete supports with embedded wire ties for reinforcement placed on grade. Elsewhere, use wire bar supports.
- D. Welding electrodes: AWS D1.4, Table 7.1, low hydrogen electrodes, E8018 for A706 Grade 60 steel.

2.2 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI - Manual of Standard Practice.
- B. Bending and Forming:
 - 1. Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials.
 - 2. Do not heat reinforcement for bending.
 - 3. Bend bars No. 6 size and larger in the shop only.
 - 4. Bars with unscheduled kinks or bends are subject to rejection.
 - 5. Use only tested and approved bar materials.
- C. Welding:
 - 1. Use only ASTM A706 steel where welding is proposed:
 - a. Perform welding where shown or approved, by the direct electric arc process in accordance with AWS D1.4 using specified low hydrogen electrodes.
 - b. Preheat six inches (6") each side of joint.
 - c. Protect joints from drafts during the cooling process; accelerated cooling is prohibited.
 - d. Do not tack weld bars.
 - e. Welding shall not be done on or within two (2) bar diameters of any bent portion of a bar that has been bent cold.
 - f. Welding of crossing bars shall not be permitted for assembly reinforcement unless authorized by the SEOR.
 - g. Clean metal surfaces to be welded of all loose scale and foreign material.
 - h. Clean welds each time electrode is changed and chip burned edges before placing welds.
 - i. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration to the base metal.
 - j. Cut out welds or parts of welds found defective with chisel and replace with proper welding.
 - k. Fillet welds may be considered prequalified per AWS D1.4.
 - l. Other welds are to be qualified per AWS D1.4 except if performed with GTAW..
- D. Where ASTM A615 steel is to be used or occurs in existing elements and is to be welded:
 - 1. Complete chemical analyses shall be performed to determine chemical composition and, for a new bar, provided in the mill certifications to determine weldability in accordance with ACI 318 with modifications per AWS D1.4.
 - 2. The carbon equivalency (CE) shall be clearly defined and bars with a CE above 0.75 shall not be welded.
 - 3. Welding Procedure Specifications and supporting PQRs with required testing per AWS D1.4 shall be provided for review and approval prior to welding.
 - 4. These WPS and PQRs shall be specific to the CE as determined above, and shall, in addition to the other AWS requirement, include minimum and maximum preheat and interpass temperatures that are specified to the CE. This preheat and interpass

temperature shall be strictly enforced in the field.

5. If separate shipments of bars vary the weldability, the process listed in the above requirements shall be repeated for these new bars.
- E. Locate reinforcing splices not indicated on Drawings at point of minimum stress. Review locations of splices with SEOR.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Before placing bars, and again before concrete is placed, clean bars of loose rust and/or mill scale, dirt, oil, or any other coating that may be deleterious or could reduce bond with the concrete.
- B. Securing in place:
1. Accurately place bars and wire tie in precise position where bars cross.
 2. Bend ends of wire ties away from the forms.
 3. Wire tie bars to the corners of ties and stirrups.
 4. Support bars according to the Concrete Reinforcing Steel Institute (CRSI) "Placing Reinforcing Bars," using approved accessories and chairs.
 5. Place precast concrete cubes with embedded wire ties to supporting reinforcing steel bars in concrete placed on grade and in footings.
 6. Take adequate precautions to ensure that reinforcing bar position and spacing is maintained during concrete placement.
- C. Do not displace or damage vapor barrier.
- D. Maintain concrete cover around reinforcing per requirements on Drawings.
- E. Splices:
1. Do not splice reinforcing bars at the points of maximum stress except where indicated.
 2. Lap splices as shown or required to develop the full strength or stress of the bars.
 3. Stagger splices in horizontal wall bars at least 48 inches longitudinally in alternate bars and opposite faces.
- F. Field Welding: As specified for fabrication.

3.2 FIELD QUALITY CONTROL

- A. Comply with all pertinent provisions of Section 01 40 00: Quality Requirements.
- B. Supervision: Perform Work to this Section under supervision of a capable superintendent.
- C. An independent testing agency, as specified in Section 01 40 00: Quality Requirements, shall inspect installed reinforcement for conformance to Contract Documents before concrete placement.
- D. Where welding is done in the shop or at the site, perform welding of reinforcing bars under inspection of the testing laboratory welding inspector in accordance with Chapter 17A of the CBC. The welding inspector shall make a systematic record of all welds:
1. Identification marks of welders.
 2. List of defective welds.
 3. Manner of correction of defects:

- a. The welding inspector shall check the material, equipment details of construction and procedures, as well as the welds. The inspector shall check the ability of the welder. The welding inspector shall furnish the structural Engineer and the enforcement agency with a verified report that the welding required to be inspected is proper and has been done in conformity with the approved Plans and Specifications. The welding inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics, or any other aid to visual inspection, which the inspector may deem necessary to assure the adequacy of the welding.

END OF SECTION 03 20 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings and foundation walls.
 - 2. Interior Slabs-on-grade.
- B. Related Sections:
 - 1. Section 03 20 00 – Concrete Reinforcing
- C. Special Coordination Requirements: Coordinate with the work of the following sections to identify the finish flooring manufacturer's concrete slab requirements. Such requirements may be over and above the requirements of the Contract Documents and may require additional materials, means, or methods, which shall be included as part of the Work.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Samples: For vapor retarder.
- E. Certificates: Weighmaster's Certificates.

1.05 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials.
 2. Admixtures.
 3. Waterstops.
 4. Curing compounds.
 5. Floor and slab treatments.
 6. Bonding agents.
 7. Adhesives.
 8. Vapor retarders.
 9. Semirigid joint filler.
 10. Joint-filler strips.
 11. Repair materials.
- B. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
 2. Vapor Retarders. Include summary of test results per paragraph 9.3 of ASTM E1745 and Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
- C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.06 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. California Building Code, 2022 Edition.
 2. CCR Title 24, Part 2
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Source Quality Control: Furnish Weighmaster's Certificates for all concrete.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel"
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete,"
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 3. ACI 305R, "Hot Weather Concreting".
 4. ACI 306R, "Cold Weather Concreting".
 5. ACI 308, "Standard Practice for Curing Concrete".
- F. Concrete Testing Service: Engage a qualified independent testing agency approved by DSA to perform material evaluation tests and to design concrete mixtures.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

- a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
- 1. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, all structural reinforcing to be Grade 60, Grade 60 for #3 bars and larger, using deformed bars for #3 and larger.
- B. Welded Reinforcing Bars: Low-Alloy-Steel Reinforcing Bars, ASTM A 706/A 706M, deformed.
- C. Do not use reinforcement having any of the following defects:
- 1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances.
 - 2. Bends or kinks not indicated on the Drawings or required for this Work.
 - 3. Bars with cross-section reduced due to excessive rust or other causes.

2.03 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type II/V. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: ASTM C 33.
 - 1. Coarse-Aggregate Size: 1 inch nominal aggregate size.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal aggregate size.
- D. Water: ASTM C 94 and potable.

2.05 ADMIXTURES

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

6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.06 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Shall have all of the following qualities: Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5), ASTM E1745 Class A strength, 15 mils minimum thickness, provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

1. Products: Subject to compliance with requirements, acceptable products:

- a. Stego Industries, LLC; Stego Wrap 15 mil Class A. (Basis of Design)
- b. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
- c. Fortifiber Building Systems Group; Moistop Ultra 15.
- d. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
- e. Insulation Solutions, Inc.; Viper VaporCheck 16.
- f. Meadows, W. R., Inc.; Perminator 15 mil.
- g. Raven Industries Inc.; Vapor Block 15.
- h. Reef Industries, Inc.; Griffolyn 15 mil Green

- B. Accessories: Include manufacturer's recommended seaming tape, sealing tape, mastic, and penetration prevention.

1. Seams:

- a. Stego Tape by Stego Industries LLC

2. Sealing Penetrations of Vapor barrier:

- a. Stego Mastic by Stego Industries LLC
- b. Stego Tape by Stego Industries LLC

3. Perimeter/edge seal:

- a. Stego Crete Claw by Stego Industries LLC
- b. Stego Term Bar by Stego Industries LLC
- c. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC
- d. Use of one-sided seaming tape to seal the perimeter must be submitted to the architect for pre-approval.

4. Penetration Prevention:

- a. Beast Foot by Stego Industries LLC

5. Vapor Barrier-Safe Screed System

- a. Beast Screed by Stego Industries, LLC

- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.07 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.

- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309.
 - 1. Shall not discolor concrete or other materials, shall not leave an oily residue upon evaporation of solvent.
 - 2. Shall afford moisture loss not greater than 0.055 grams/cm² at minimum average of 300 square feet.
 - 3. Meet State of California Air Regulation Board Solvent Emission Standards.

2.08 RELATED MATERIALS

- A. Non-shrink Grout:
 - 1. Factory premixed grout; ASTM C1107.
 - 2. Compressive strength: 5,000 psi at 28 days.
- B. Exterior Concrete Walks: Provide a capillary break consisting of 2" of clean dry sand, ASTM C33, evenly spread on top of the compacted subgrade.

2.09 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 - 2. All concrete mix designs shall be prepared and stamped by a California registered Civil Engineer.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 15 to 20 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

- D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days unless otherwise noted.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.58.
 - 3. Slump Limit: 3 inches, plus or minus 1 inch.
- B. Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

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

PART 3 - EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Construct forms tight enough to prevent loss of concrete mortar.

- D. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- E. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. In no case shall any bolt or anchor be stabbed in place while or after the concrete is poured.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved **at least 70 percent of its 28-day design compressive strength**.
 - 2. Do not strip vertical concrete in less than 7 days.
 - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 3. Lap joints 6 inches and seal with manufacturer's recommended tape.
 4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 6. No penetration of the vapor barrier is allowed except for reinforcing and permanent utilities. For interior forming applications, avoid the use of stakes driven through vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into peel-and-stick stake base/foot. Ensure stake base/foot's peel-and-stick adhesive base is fully adhered to the vapor barrier.
 7. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
 8. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.
 9. Do not saturate the sand cushion.
 10. If sand is saturated prior to placement of concrete, remove the sand and replace.
 11. Protect all installed moisture barrier construction from precipitation and water penetration by covering and providing positive drainage away from the moisture barrier.
 12. Cover slab openings and block-outs around columns to prevent water penetration of moisture barrier.

3.06 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
2. Clean reinforcement and remove loose dust and mill scale, earth, oil, and other materials which reduce bond or destroy bond with concrete.
3. Position, support, and secure reinforcement against displacement by forms, construction, and the concrete placement operations. Provide metal chairs, dobies, or other aids manufactured for this purpose.
4. Place reinforcement to obtain the required concrete coverages for concrete protection.

3.07 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-inch as follows:
 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Saw cut slab as soon as surface has hardened to where it can support the equipment and operator, normally within 2 hours after finishing. Use saw which is specially designed for cutting fresh concrete, such as "Soff-Cut" or equal.
- D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 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 specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature,

provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.09 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Except as may be shown otherwise on the drawings, provide the following finishes at the indicated locations.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces that are to receive concrete floor toppings or mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
 - 3. The contractor shall anticipate that grinding will be required as a result of curling or other slab defects. Grinding required to bring the slab surface into acceptable tolerances for finished flooring installation shall be included as part of the Work.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

- G. Finish at Pool Pit Area: Finish slabs below pools per pool manufacture requirements.

1. Comply with flatness and levelness tolerances as required by pool manufacture.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each day, but not less than once for each 2000 square feet of surface area for slabs or walls.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION

**SECTION 04 05 00
MORTAR AND GROUT**

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- 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 is related to mortar and grout installation and includes:
1. Provisions of all materials, labor, and accessories as required and specified for complete mortar and grout installation in masonry walls.
- B. Related Sections:
1. Section 03 30 00: Cast-In-Place Concrete.
 2. Section 04 22 00: Concrete Unit Masonry.
 3. Section 07 92 00: Joint Sealants.
 4. Section 09 30 00: Tiling.
- C. Reference Standards:
1. ASTM C144 Aggregate for Masonry Mortar.
 2. ASTM C150 Portland Cement.
 3. ASTM C207 Hydrated Lime for Masonry Purposes.
 4. ASTM C270 Standard Specification for Mortar For Unit Masonry.
 5. ASTM C404 Aggregates for Grout.
 6. ASTM C476 Standard Specification for Grout for Masonry.
 7. ASTM C1019 Method of Sampling and Testing Grout.
 8. 2022 California Building (CBC), with State of California Amendments:
 - a. 2022 California Building (CBC), Section 2103A.
 9. Masonry Standards Joint Committee (MSJC).

1.3 SUBMITTALS

- A. Mix design for mortar and grout shall be submitted for review.
- B. Supplier's certificates indicating materials comply with the specifications below. They shall include, but are not necessarily limited to:
1. Aggregates.
 2. Cement.
 3. Admixtures.

1.4 QUALITY ASSURANCE

- A. Tests and Inspections:
1. A testing program is required prior to start of construction. Testing program to be done in compliance with the 2022 CBC requirements and in collaboration with the testing laboratory, design team, Contractor, and Owner, and submitted for review by the agency in charge of building enforcement. Requirements below are minimum requirements; additional requirements may be required in final testing program.
 2. All tests and inspections herein are to be performed by an independent testing laboratory approved by the building official.
 3. Mortar and grout tests:

- a. At the beginning of masonry work, at least one (1) test sample each of mortar and grout shall be taken on three (3) successive working days, then once per week with at least one sample taken for each 5,000 square feet of wall area, or fraction thereof:
 - 1) Test specimens shall be made in accordance with ASTM C1019 for grout and ASTM C780 for mortar.
 - 2) Test specimens shall be continuously stored in moist air until tested.
 - 3) Mortar shall show a compressive strength of not less than 1,800 psi at 28 days. Grout shall show a compressive strength of not less than 2,000 psi at 28 days.
4. A special inspector shall be employed per CBC Section 1705A.4 during the placement of all units, placement of all reinforcing steel, during all grouting operations, and during taking of all test specimens.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement: ASTM C150, Type I or II, low alkali; natural gray.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Quicklime: ASTM C5.
- D. Lime Putty:
 1. Made from hydrated lime or quicklime:
 - a. If made from quicklime, other than processed pulverized quicklime, slake lime and then screen through a No. 16 mesh sieve. Before using, store and protect slaked and screened lime putty for not less than ten (10) days.
 - b. Processed pulverized quicklime shall be slaked for not less than 48 hours, and shall be cool when used.
 - c. Lime putty prepared from hydrated lime may be used immediately after mixing.
 - d. Lime putty prepared from quicklime or pulverized quicklime shall have a plasticity figure, after slaking and screening, of not less than 200, and shall weigh not less than 83 pounds per cubic foot. Lime putty prepared from hydrated lime shall conform to ASTM C207, Type S.
- E. Aggregate:
 1. For mortar: ASTM C144.
 2. For grout: ASTM C404.
- F. Admixture: **Sika Grout Aid by Sika Corporation U.S.**
 1. Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.
- G. Water: Suitable for domestic consumption.

2.2 MORTAR

- A. Mortar shall be Type S having a 28-day compressive strength of not less than 1,800 psi and shall conform to CBC Section 2103A.9.
- B. Mortar shall be made with admixtures that are proportioned, added and mixed in strict accordance with manufacturer's directions.
- C. Mortar mix shall be proportioned by volume; one-part portland cement, not less than 1/4-

part nor more than 1/2-part lime putty, and sand totaling not less than 2-1/4 nor more than three (3) times sum of volumes of cement and lime used:

1. Total clay content shall not exceed two percent (2%) of sand content or six percent (6%) of cement content.

2.3 GROUT

- A. Grout shall have a 28-day compressive strength of not less than 2,000 psi. Proportion by volume, and with sufficient water to produce consistency for pouring without segregation so that grout will flow into masonry joints. Grout shall conform to CBC Section 2103A.13.
- B. Fine Grout:
 1. One-part portland cement, to which may be added not more than 1/10-part lime putty, and three-parts sand.
 2. Fine grout shall be used for all grout spaces less than three inches (3") wide.
- C. Coarse Grout:
 1. One-part portland cement, to which may be added not more than 1/10-part lime putty, three-parts sand, and not less than one-part nor more than two-parts pea gravel (3/8-inch maximum aggregate size).
 2. Coarse grout shall be used in grout spaces three inches (3") wide or more.
- D. Add Sika Grout Aid admixture to grout at the rate of one (1) pound per 100 pounds cementitious material.

PART 3 EXECUTION

3.1 MIXING MORTAR AND GROUT

- A. Accurately measure materials in suitably calibrated devices; shovel measurements are not acceptable. Each 94-pound sack of portland cement will be considered as one (1) cubic foot.
- B. Place sand, cement, and water in mixer, in that order, and mix for at least two (2) minutes. Add lime putty and continue mixing as long as necessary to secure a uniform mass, but in no case less than ten (10) minutes.
- C. Use mixers of at least one (1) sack capacity; batches requiring fractional sacks will not be permitted unless cement is weighed for each batch.

3.2 GROUTING PROCEDURES

- A. Specified under 04 22 00: Concrete Unit Masonry.

3.3 RETEMPERING

- A. When necessary to retemper mortar, add water and remix; retempering by dashing water over mortar will not be permitted.
- B. Any mortar that is unused within 30 minutes after initial mixing and any mortar that has begun to set shall not be used.

3.4 DEFECTIVE MORTAR OR GROUT

- A. Should the strength of mortar or grout fall below that specified, remainder of Work shall be

adjusted to reach required strength. Work in place representing inferior grout and mortar and indicating a strength less than the minimum specified shall be tested by taking and testing core samples. Number and location of cores shall be determined by the structural Engineer.

- B. Should compression tests of cores fail to meet required strength, masonry shall be deemed to be defective and shall be removed and replaced at no cost to Owner.
- C. Costs relative to taking and testing of core samples shall be paid by Owner and will be deducted from Contract amount. Cost of patching core holes shall be borne by Contractor.

END OF SECTION 04 05 00

**SECTION 04 21 13.13
THIN BRICK**

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: Section is related to thin brick masonry units and its installation and includes:
1. Thin brick facing.
 2. Mortar.
 3. Embedded flashing.
 4. Control joints.
 5. Fasteners.
- B. Related Sections:
1. Section 03 30 00: Cast-in-Place Concrete.
 2. Section 04 05 00: Mortar and Grout.
 3. Section 07 92 00: Joint Sealants

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
1. ASTM A 525 – Steel Sheet Zinc-Coated – hot dip galvanized
 2. ASTM C 33 - Specification for Concrete Aggregates.
 3. ASTM C 67 - Test Methods of Sampling and Testing Brick and Structural Clay Tile.
 4. ASTM C 79 – Gypsum Sheathing board
 5. ASTM C 270 - Specification for Mortar for Unit Masonry.
 6. ASTM C 578 – Preformed Cellular Polystyrene Thermal Insulation
 7. ASTM C 482-02 Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement
 8. ASTM C 270 - Specification for Mortar for Unit Masonry.
 9. ASTM C 1019 - Method of Sampling and Testing Grout.
 10. ASTM C 1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale.
 11. ASTM C 1325 – Standard specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
 12. ASTM C 1780 – Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer.
- B. American National Standards Institute (ANSI)
1. A108.11 Installation of cementitious backer units.
 2. A108.13 Installation of waterproof membranes for thin-set brick.
 3. A118.1 Dry-set Portland cement mortar.
 4. A118.4 latex Portland cement mortar.
 5. A118.9 Cementitious backer units.
 6. A118.10 Waterproof membranes for thin-set brick.
 7. A136.1 Organic Adhesives, Type I and Type II
- C. Code and Other References:

1. International Building Code (ICC), adopted addition.
2. California Building Code Requirements and Specification for Masonry Structures (TMS 402/602), adopted addition.
3. PCA Plaster and Stucco Handbook, latest edition
4. TCNA Handbook for Ceramic, Glass, and Stone Tile Installations, latest edition.
5. Masonry Veneer Manufacturers Association Installation Guide and Detailing for Compliance with ASTM C1780, latest edition

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data, and Evaluation Reports as required for installation.
- C. Shop Drawings: Include elevations of each wall indicating type and layout of units.
- D. Samples: Provide sample of thin brick for color and texture approval.
- E. Test Reports from an independent testing laboratory showing compliance with applicable specifications.
- F. Provide manufacturer's specification, data, and installation for review prior to fabrication of work.
- G. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect
- H. Closeout Submittals: Provide manufacturer's maintenance instructions for cleaning and maintenance.

1.5 QUALITY ASSURANCE

- A. Continuous Inspection:
 1. Employ a qualified masonry inspector for continuous inspection of the masonry work. Acceptance by a State or municipality having a program of examining and certifying masonry inspectors will be considered adequate qualifications. The masonry inspector shall be at the site during all masonry construction and perform the following duties:
 - 1) Review Drawings and Specifications and meet with the CONTRACTOR to discuss requirements before work commences.
 - 2) Before masonry work commences, CONTRACTOR and the Contractor's Quality Control Representative shall attend meeting with ENGINEER to review the requirements for surveillance and quality control of the masonry work.
 - 3) Check brand and type of cement, lime (if used), and source of sand.
 - 4) Ensure that the backing is continuous, rough, and moisture resistant to receive units.
 - 5) Observe field proportioning of mortar. Visually check aggregate to determine uniformity of grading, cleanliness, and moisture.
 - 6) Ensure that joints are full of mortar and kept tight during work.
 - 7) Continuously observe placing of grout.
 - 8) Perform or supervise performance of required sampling and testing.
 2. Certification: Furnish manufacturer's certification that clay thin brick units provided meet or exceed the requirements of this specification.

3. Keep complete record of inspections. Report daily to the Contractor's Quality Control Representative the progress of the masonry inspection.
- B. Mock-up:
- Prior to starting construction of masonry, construct minimum 4 foot square mock-up.
1. Use accepted materials, containing each different kind and color of brick masonry units to illustrate wall design.
 2. Show color range, texture range, bond, mortar color, joint tooling, critical design details and quality of workmanship.
 3. Masonry construction may not proceed until the Architect./ Engineer approves mock-up.
 4. When not accepted, construct another mock-up.
 5. When accepted, mock-up will be standard of comparison for remainder of masonry work.
 6. Upon completion and acceptance of Project, dispose of mock-ups in legal manner at offsite location.
- C. Pre-installation Conference: Conduct conference on site min two weeks prior to install.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units above ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.
- B. Cover and protect masonry units from inclement weather to maintain quality control and physical requirements.
- C. Transport and handle brick masonry units as required to prevent discoloration, chipping, and breakage.
- D. Locate storage piles, stacks, and bins to protect materials from heavy traffic.
- E. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

1.7 PROJECT CONDITIONS

- A. Cold Weather Requirements:
 1. In accordance IBC Section 2104.3.
 2. Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit (4 degrees Celsius).
- B. Hot Weather Requirements:
 1. In accordance with CBC Section 2104.4.
 2. When ambient air temperature exceeds 100 degrees Fahrenheit (38 degrees Celsius), or when ambient air temperature exceeds 90 degrees Fahrenheit (32 degrees Celsius) and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
 3. Wet mortar board before loading and cover mortar to retard drying when not being used.
 4. Do not spread mortar beds more than 48 inches (1.22 m) ahead of placing masonry units.
 5. Place masonry units within one minute of spreading mortar.
- C. Wetting of Brick: shall be required at the time of laying if the unit's initial rate of absorption (IRA) exceeds 30 grams per 30 square inches per minute or 1 g/ 645mm².

PART 2 PRODUCTS

2.1 MANUFACTURER:

- A. Glen Gery or Architect approved equivalent.
- B. Type: ASTM C -216, Grade SW, Type FBA thin veneer brick.
 - 1. Surface Texture: Smooth
 - 2. Colors: As designated on the Drawings
 - 3. Bond: stack bond
 - 4. Maximum compressive strength 8,000 psi.
 - 5. Size: ½" (13mm), 2 1/4" (57 mm), 7 5/8" (194mm)
 - 6. Special Sizes and Shapes: As required for window and door locations and custom sills where indicated, corners, and other special applications to minimize cutting.
 - 7. Substitutions: None allowed

2.2 SETTING BED MORTAR

- A. Site mixed: Meet requirements of ASTM C270 Type N or Type S. Not for use with cement board substrate
- B. Preblended: Meet requirements of ASTM C1714/C1714M Type S. Not for use with cement board substrate
- C. Modified mortar for use with cement board substrate: comply with ANSI A118.4 or A118.15
- D. Mortar Bed Installations: For mortar setting bed (scratch) or brown coat as the substrate for thin brick work; work to conform to ANSI A108.1. or ACI 530
 - 1. Portland Cement Mortar
- E. Proportions: 1 part Portland cement (ASTM C 150 Types I, IA, II, IIA, III, IIIA or V) less than 6 months old. 1 part dehydrated lime (ASTM C207), 6 parts sand (ASTM C-144)
Property: Portland cement -lime mortar, compressive strength 750 psi, water retention 75%, air content 14%, sand 2 ¼- 3 ½ the sum of the separate volumes of cementitious materials sand (ASTM C-114)

2.3 POINTING MORTARS

- A. Mortar used to grout or tuck-point mortar joints (sometimes called grouting mortars) between thin brick units after they are adhered to the substrate wall. Mix by proportion: 1 part Portland cement (ASTM C150); 1 part hydrated lime (ASTM C207); 6 parts sand (ASTM C144), or Modified Epoxy emulsion mortar/grout conforming to ANSI 118.07.
 - 1. Site mixed: Meet requirements of ASTM C270 Type N or Type S.
 - 2. Preblended: Meet requirements of ASTM C1714/C1714M Type S.

2.4 WEATHER RESISTIVE BARRIER (WRB)

- A. Sheet goods: For exterior wall (not roof) applications. compatible with cementitious plaster and mortar capable of bond capacities of 50 psi (0.34 MPa) shear and tension bond
- B. Elastomeric liquid/fluid applied: compatible with cementitious plaster and mortar capable of bond capacities of 150 psi (1.03 MPa) shear and tension bond.

2.5 DRAINAGE LAYER

- A. Sheet or roll goods comprised of woven plastic strands, plastic strand mesh, profiled (ribbed, or dimpled) plastic sheeting, all faced with filter fabric. Alternatively, the drainage layer may be created with a filter membrane with dimples, or "buttons", other protrusions bonded to the surface which create a 1/16" (1 mm) (minimum) air space, or other suitable material to provide a separation that allows water to drain out of the wall system.
- B. HydroGap® by Benjamin Obdyke, or equivalent
- C. Mortairvent® by Advanced Building Products, or equivalent
- D. Sure Cavity™ by MTI, or equivalent

2.6 LATH (FURRED)

- A. 18 Gauge (43mils; 1.4mm) galvanized woven wire mesh – ASTM C1032
- B. 3/8" (9.5mm) rib, 3.4 lb./yd² (1.9kg/m²) self-furring expanded galvanized metal lath – ASTM C847
- C. 2.5 lb/yd² (1.4kg/m²) (or heavier) self-furring metal lath – ASTM C874
- D. Welded wire lath – ASTM C933
- E. Proprietary integral woven fiberglass lath and profiled drainage membrane – See 2.09-F.

2.7 FLASHING

- A. Corrosion resistant plastic, copper, stainless steel, painted metal, coated metal as shown on the drawings. See section 076000 for additional information.

2.8 ACCESSORIES

- A. Weep screeds: Corrosion resistant with 3.5" (89mm) (minimum) vertical attachment flange (that terminates behind WRB)
 - 1. Metal weep screed: not less than 26 gage; .0179 inches (0.45mm)
 - 2. Plastic weep screed: not less than 0.05 inches (1.3mm)
- B. Casing beads: Corrosion resistant
 - 1. Metal weep screed: not less than 26 gage; .0179 inches (0.45mm)
 - 2. Plastic weep screed: not less than 0.05 inches (1.3mm)
- C. Elastomeric sealants. Sized for calculated movement. Section 079200
- D. Fasteners: ASTM C1063
 - 1. For steel studs: corrosion resistant screws; coated or bi-metallic (mild [drill] tip with stainless threaded shank), for fastening drainage plane material and lath material to substrate wall; rated for resistance to moist environments. Penetrate stud to expose 3 full threads through steel studs
 - 2. For wood studs: corrosion resistant staples, corrosion resistant roofing nails, or corrosion resistant screws and washers, all of sufficient length to penetrate a minimum of 3/4" into wall framing members
 - 3. For concrete or CMU: corrosion resistant concrete screws (with 1 1/4" minimum penetration into sound substrate) or corrosion resistant powder actuated fasteners (with 1" minimum penetration into sound substrate)
 - 4. Follow fastener manufacturer's recommendations for installation into CMU

- 5. Fasteners intended to secure lath shall have sufficiently large heads or added corrosion resistant washers large enough to not pull through the lath.
- E. Fluid applied bond coat – used on the face of rigid insulation
- F. Proprietary Lath Systems – follow manufacturer's recommendations for installation
- G. Punched galvanized sheet metal: TABS II or equivalent
- H. Thermoset reinforced plastic: Speedymason or equivalent
 - 1. Mortar set
 - 2. Peel n' stick

PART 3 EXECUTION

3.1 VENEER SUBSTRATE PREPARATION

- A. Stucco
 - 1. Remove all deleterious substances (form release, curing compounds, paint, graffiti, etc.)
 - 2. Wash surface and allow to dry
 - 3. Cleaning may be waived/eliminated where proprietary lath systems are used, pending acceptance of Architect and lath system manufacturer.

3.2 MORTAR JOINTS

- A. Make joints straight, clean, smooth, and uniform in thickness.
- B. Pointing: Tool exposed joints, concave.
- C. Tool joints while slightly moist and thumbprint hard.
- D. Joint Thickness: Make vertical and horizontal joints as required to achieve nominal dimensions on drawings and within tolerances listed in ACI 530.1 Section 3.3 G.
- E. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.

3.3 CUTTING BRICK MASONRY UNITS

- A. When possible, use full units of the proper size in lieu of cut units.
- B. Cut units as required to form chases, openings, for anchorage, and for other appurtenances, and at all movement joints and terminations, as required, so as to eliminate units bridging across movement joints (or cracks) in substrate.
- C. Cut and fit units with power-driven carborundum or diamond disc blade saw.
- D. Clean back of units after cutting to remove dust and other deleterious material(s).

3.4 CONTROL JOINTS / EXPANSION JOINTS

- A. Size joints to accommodate anticipated movements with respect to moisture and thermal gradients in addition to building movements commensurate with the movement potential of

the joint material(s).

- B. Provide in masonry walls where **indicated on the Drawings.**
- C. Make full height and continuous in appearance.
- D. Control and expansion joints must be continuous through the backing, unless detailed otherwise.
- E. Insert control joint filler in joints as wall is constructed.
- F. Insert 50% compressible elastomeric (neoprene or equivalent) expansion joint material in properly sized expansion joints.
- G. Apply sealant as specified in Section 07 92 00.

3.5 FLASHING

- A. Flashing must be installed at all through wall penetrations and at lower boundaries of the adhered thin brick veneer installations.
- B. Flashings will be integrated with the WRB materials to provide effective control of moisture exiting the wall assembly, with sealed corners, end dams and other accessories as needed.

3.6 OTHER EMBEDDED ITEMS

- A. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.

3.7 PATCHING

- A. Patch exposed brick masonry units at completion of the Work and in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.

3.8 MISCELLANEOUS

- A. Build in required items, such as anchors, flashings, weep screeds, sleeves, electrical boxes, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

3.9 WEATHER CONTROL

- A. Weather resistive Barrier
 - 1. Suitable as substrate to cementitious plaster (stucco) with minimum bond capacity of 150 psi tensile and shear strength for applications where a stucco substrate is added.
 - 2. Typical sheet or roll goods application as substrate to cementitious plaster/stucco/cement board: Applied in 2 layers, shingle fashion, from the bottom of the wall.
 - 1) When covered by a drainage layer, then single layer of WRB is adequate.
 - 3. May be liquid/fluid applied membrane barrier suitable for bonding to cementitious plaster (stucco) and mortar where no lath and cementitious plaster is used.
- B. Water Repellent
 - 1. Apply water repellent as specified in Section 071900 where directed or specified on drawings.
 - 2. Water repellent should have a high vapor transmission rate and repel liquid water. Silanes,

siloxanes, or combinations of those, are typical.

3.10 FIELD QUALITY CONTROL

- A. Have minimum 3 masonry units of each type proposed for Project tested in accordance with ASTM C 67 to verify conformance to Specifications.
- B. Tests shall include absorption, Initial Rate of absorption and unit weight.
- C. Employ and pay acceptable independent testing laboratory to perform testing
- D. Per ASTM C 1088, after brick are placed in usage, the manufacturer or the manufacturer's agent shall not be held responsible for compliance of brick with the requirements of ASTM C 1088 for chippage and tolerances.

3.11 CLEANING

- A. Exercise extreme care to prevent mortar splashes.
- B. Do not attach construction supports to masonry walls.
- C. Wash off brick scum and grout spills before scum and grout set.
- D. Remove grout stains from walls using cleaning agent and methods recommended by brick manufacturer.
- E. Clean exposed masonry. Apply cleaning solution recommended by brick manufacturer in accordance with cleaning solution manufacturer's printed instructions and brick manufacturer's recommendations.
- F. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.
- G. Correct efflorescence on exposed surfaces with commercially prepared cleaning solution acceptable to masonry unit manufacturer.
- H. Do not use muriatic acid as cleaning solution.
- I. Do not use sandblast cleaning equipment.

3.12 FORMS AND SHORES

- A. Where required, construct forms to the shapes **indicated on the Drawings**.
 - 1. Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
 - 2. Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected.
- B. Wait at least 16 hours after grouting masonry columns or walls before applying uniform loads.
 - 1. Wait at least 64 hours before applying concentrated loads.

3.13 PROTECTION

- A. Provide temporary protection for exposed masonry corners subject to damage.
 - 1. Bracing:
- B. Adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse.
Keep bracing in place until permanent supporting elements of structure are in place.
 - 1. Limited Access Zone:
- C. Establish limited access zone prior to start of masonry wall construction.
 - 1. Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on un-scaffolded side of wall.
 - 2. Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
 - 3. Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.

END OF SECTION

END OF SECTION 04 21 13.13

SECTION 04 22 00
CONCRETE MASONRY UNIT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including, but not limited to:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcement.
 - 4. Masonry insulation.
 - 5. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 03 20 00: Concrete Reinforcing.
 - 2. Section 07 92 00: Joint Sealants.
- C. Reference Standards:
 - 1. ACI: American Concrete Institute.
 - 2. ASTM: American Society of Testing Materials.
 - 3. CMACN: Concrete Masonry Association of California and Nevada.
 - 4. NCMA: National Concrete Masonry Association.
 - 5. TEK Bulletins.
 - 6. TMS: The Masonry Society.

1.3 DEFINITIONS

- A. CMU: Concrete Masonry Unit.
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry and structural unit masonry that develops indicated net-area compressive strengths of 2000 psi at 28 days:
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602, Article 1.4B as modified by CBC 2105A.3.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.
 - 3. Determine average unit shear value of masonry by testing masonry cores according to CBC 2105A.4.

1.5 SUBMITTALS

- A. Product Data: Technical data including schedules and illustrations to indicate the performance, fabrication procedures, product variations, and accessories for each type of product.

- B. Shop Drawings:
 - 1. Masonry units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Show elevations of reinforced walls.
 - 3. Fabricated flashing: Detail corner units, end dam units, and other special applications.
- C. Samples:
 - 1. Submit each type and color of the following:
 - a. Exposed or decorative CMU.
- D. Material Certificates:
 - 1. Submit for each type and size:
 - a. Masonry units: Include data on material properties and material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - c. Integral water repellent used in CMU.
 - d. Cementitious materials: Include name of manufacturer, brand name, and type.
 - e. Mortar admixtures.
 - f. Preblended, dry mortar mixes: Include description of type and proportions of ingredients.
 - g. Grout mixes: Include description of type and proportions of ingredients.
 - h. Reinforcing bars.
 - i. Joint reinforcement.
 - j. Anchors, ties, and metal accessories.
- E. Mix Designs:
 - 1. Submit for each type of mortar and grout with description of type and proportions of ingredients:
 - a. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 - b. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- F. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 402/602.
- G. Cold Weather and Hot Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
- H. Statement of Understanding: Provide statement signed by Contractor and masonry subcontractors that for high-lift Grouting, the contractor has read, understood, and will follow all requirements of DSA Interpretation of Regulations (IR) 21-2.13. A copy of the IR shall be on site for review.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code:
 - a. Comply with applicable requirements of Chapter 21A of the 2022 California Building Code: (CBC).
 - 1) Masonry standard: Comply with TMS 402/602 in addition to the requirements in the Contract Documents.

- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source.
- D. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING AS APPROVED BY THE ARCHITECT AND DSA

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2 PRODUCTS

2.1 UNIT MASONRY

- A. Masonry Standard: Comply with TMS 402/602, in addition to the requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed work or within 20 feet (6 m) vertically and horizontally of a walking surface.
- C. Fire Resistance Ratings:
 - 1. Comply with requirements for fire resistance rated assembly designs indicated:
 - a. Where fire resistance rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes:
 - 1. Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated:
 - a. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Integral Water Repellent:

1. Provide units made with integral water repellent for exposed units and where indicated:
 - a. Liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen:
 - 1) Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a) Moxie International
 - b) BASF Corporation.
 - c) GCP Applied Technologies.
- C. CMU:
 1. ASTM C90, loadbearing
 - a. Fire Rating: Two (2) hours or four (4) hours.
 - b. Unit compressive strength: Provide units with minimum average net-area compressive strength of 2,150 psi (14.8 MPa).
 - c. Density classification: Lightweight unless otherwise indicated.
 - d. Size (width): Manufactured to dimensions 3/8-inch (10 mm) less than nominal dimensions of 8" wide x 8" tall x 16" long.
 - e. Exposed faces: Provide color and texture matching the range represented by Architect's sample.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMU matching adjacent CMU in color, texture, and density classification with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Comply with 2022 CBC Chapter 21A for masonry mortar and grout.
- B. Portland Cement:
 1. ASTM C150/C150M, Type I or II, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce mortar color indicated:
 - a. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
- C. Hydrated Lime: ASTM C207, Type S (loadbearing).
- D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients conforming to ASTM C270 for mortar.
- E. Mortar Pigments:
 1. Natural and synthetic iron oxides and chromium oxides compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) Davis Colors.
 - 2) Lanxess Corporation.
 - 3) Solomon Colors, Inc.

- F. Colored Cement Products:
 - 1. Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements and containing no other ingredients:
 - a. Colored portland cement-lime mix:
 - 1) Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a) Lehigh Hanson.
 - b) LafargeHolcim.
 - b. Formulate blend to produce color selected.
 - c. Pigments shall not exceed ten percent (10%) of portland cement by weight.
- G. Aggregate for Mortar: ASTM C144.
- H. Aggregate for Grout: ASTM C404.
- I. Cold Weather Admixture:
 - 1. Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) BASF Corporation.
 - 2) Euclid Chemical.
 - 3) GCP Applied Technologies.
- J. Water Repellent Admixture:
 - 1. Liquid water repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) BASF Corporation; Construction Systems.
 - 2) Euclid Chemical Company (The); an RPM company.
 - 3) Grace Construction Products.

- K. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M
- B. Reinforcing Bar Positioners:
 - 1. Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Form units from 0.148-inch (3.77 mm) steel wire, hot dip galvanized after fabrication. Provide units designed for number of bars indicated:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Wire-Bond.

2.6 TIES AND ANCHORS

- A. Ties and Anchors: Extend ties and anchors a minimum 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16 mm) cover on outside face.

- B. Materials:
 - 1. Provide ties and anchors made from materials complying with the following unless otherwise indicated:
 - a. Hot dip galvanized, carbon steel wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
 - b. Stainless steel wire: ASTM A580/A580M, Type 306.
- C. Individual Wire Ties:
 - 1. W-shaped ties with ends bent 90 degrees to provide hooks not less than two inches (50 mm) long may be used for rock veneer.
 - 2. Wire: Fabricate from #9AWG corrosion resistant wire.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1, compressible up to 35 percent, of width and thickness indicated, formulated from urethane or PVC.
- B. Preformed Control Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond Breaker Strips: Asphalt saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.8 MASONRY CLEANERS

- A. Detergent Cleaner: Bucket and brush hand cleaning method, BIA Technical Notes 20.
- B. Proprietary Acidic Cleaner:
 - 1. Cleaner designed for removing mortar/grout stains, efflorescence, and construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) PROSOCO, Inc.
 - 2) Diedrich Technologies, Inc.

2.9 MORTAR AND GROUT MIXES

- A. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated:
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime mortar.
 - 4. For reinforced masonry, use portland cement-lime mortar.
 - 5. Add cold weather admixture (if used) at same rate for mortar exposed to view, regardless of weather conditions to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to site.

- C. Mortar for Unit Masonry: Comply with ASTM C270, Type S.
- D. Grout for Unit Masonry - Comply with ASTM C476:
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (coarse) that complies with TMS 402/602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C476, for specified 28-day compressive strength not less than 2,000 psi (14 MPa).

2.10 LIQUID SURFACE TREATMENTS

- A. Penetrating Liquid Treatment:
 - 1. Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components, odorless, that penetrates, hardens, and densifies concrete surfaces:
 - a. Basis-of-design product: Subject to compliance with requirements, provide Moxie International Inc.; **Moxie Shield 1400 Surface Sealer or Moxie Shield 1300 Sealer**, P.O. Box 838 Loomis, CA 95650. Contact manufacturer's representative: P:916-251-0825, F: 877-330-1930 Email: info@moxieshield.com.
 - b. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Protection of Masonry:
 - 1. During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress:
 - a. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three (3) days after building masonry walls or columns.
- C. Stain Prevention:
 - 1. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry:
 - a. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - b. Protect sills, ledges, and projections from mortar droppings.
 - c. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - d. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold Weather Requirements (Air temperature is below 40° F):
 - 1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602 Article 1.8C:
 - a. Cold weather cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F (4 degrees C) and higher and will remain so until masonry has dried,

but not less than seven (7) days after completing cleaning.

- E. Hot Weather Requirements (Air temperature exceeds 90° F): Comply with hot weather construction requirements contained in TMS 602 Article 1.8D.

3.2 COORDINATION

- A. Build openings and chases for heating, plumbing, electrical ducts, pipes, and conduits into masonry walls as necessary. Install bolts, toggles, flashings, beams, anchors, hangers, nailing strips, wall plugs, and frames as necessary:
 - 1. Coordinate related work incorporating installation of work to prevent subsequent cutting and patching.
 - 2. Coordinate installation of steel reinforcement for reinforced masonry.
 - 3. Coordinate dampproofing, waterproofing, and air infiltration membrane activities with masonry construction.
 - 4. Coordinate placement of concrete in masonry beams, lintels, soffits, and pilasters.

3.3 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work:
 - 1. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the work.
 - 2. Verify foundations are within tolerances specified.
 - 3. Verify reinforcing dowels are properly placed.
 - 4. Verify substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.4 INSTALLATION

- A. Thickness: Build single wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.5 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
 - 2. For location of elements in Plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in ten feet (6 mm in 3 m), or 1/2-inch (12 mm) maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in ten feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in ten feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in ten feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in ten feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in ten feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
 - 2. For exposed bed joints, do not vary from bed joint thickness of adjacent courses by more than 1/8 inch (3 mm).
 - 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
 - 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).
 - 5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.6 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement type joints, returns, and offsets. Avoid using less than half size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond. Do not use units with less than nominal four-inch (100 mm) horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified. Fill in solidly with

masonry around built-in items.

- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- G. Fill all cores in hollow CMU with grout.

3.7 MORTAR BEDDING AND JOINTING

- A. Lay CMU:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct applied finishes (other than paint) unless otherwise indicated.

3.8 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 24 inches (610 mm) for block size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of eight inches (200 mm) at each jamb unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores:
 - 1. Construct formwork and shores as needed to support reinforced masonry elements during construction:
 - a. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Mortar and Units: Comply with requirements in TMS 602 Article 3.3B as amended by CBC 2104A.1.3.2:
 - 1. Remove masonry protrusions extending greater than 1/4 inch (6.4 mm) into cells or cavities to be grouted.
- C. Placing Reinforcement: Comply with requirements in TMS 602 Article 3.4 B as amended by CBC 2104A.1.3.3:
 - 1. Support reinforcement to prevent displacement caused by construction loads or by

placement of grout or mortar, beyond the allowable tolerances. Reinforcement and embedded items shall be clean, properly positioned and securely anchored against moving prior to grouting.

2. Maintain a clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least 1/4 inch (6.4 mm) for fine grout and 1/2 inch (12.7 mm) for coarse grout, and the space between masonry unit surfaces and reinforcement shall be a minimum of one bar diameter, except where cross webs of hollow units are used as supports for horizontal reinforcement. Reinforcement and embedded items shall be solidly embedded in grout.

D. Installing Anchor Bolts: Comply with requirements in TMS 602 Article 3.4 D as amended by CBC 2104A.1.3.4:

1. Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of 1/2 inch (12.7 mm) of grout between the bolt circumference and the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least 1/4 inch (6.4 mm) when using fine grout and at least 1/2 inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.
2. Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be 1/2-inch (13 mm) diameter for 6-inch (152 mm) nominal masonry, 3/4-inch (19 mm) diameter for 8-inch (203 mm) nominal masonry, 7/8-inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25 mm) diameter for 12-inch (304.8 mm) nominal masonry.
3. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.
- 4.

E. Grouting:

1. Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure
2. Comply with requirements in TMS 602 Article 3.2 F as amended by CBC 2104A.1.3.1 for cleanouts:
3. Comply with TMS 602 Article 3.5 for grout pour height as amended by CBC 2104A.1.3.5:
 - For grout pours not greater than 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry, the top of grout pour shall be at the top of constructed masonry, or within 8 inches (200 mm) of the top of the constructed masonry. Grout pours not terminated at the top of constructed masonry shall comply with TMS 602, Articles 3.5 C.3.a through 3.5 C.3.e. [OSHDP 1 & 4] After construction of each grout lift height of wall, column, pier or beam, masonry cells or cavities shall be inspected prior to placement of grout.
 - Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to approval of the enforcement agency.
 - Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to the following:
 - o Grouting shall be done in a continuous pour in lifts not exceeding 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry.
 - o An approved admixture of a type that reduces early water loss and produces an expansive action shall be used.
 - o The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour
 - o For multiple grout lifts within a grout pour, each grout lift height of wall,

- column, pier or beam shall be inspected before placement of additional units
 - Cleanout openings shall be provided at the bottom of each pour of grout
4. Comply with TMS 602 Article 3.5 for grout lift height as amended by CBC 2104A.1.3.6:
 - In no case shall lifts exceed 4 feet (1219 mm) in height.
 - Exception: The 4 feet (1219 mm) maximum lift height may be increased to 5 feet 4 inches (1625.6 mm) for 10-inch (254 mm) nominal and larger hollow-unit masonry.
 5. Comply with TMS 602 Article 3.5 for grout consolidation as amended by CBC 2104A.1.3.7:
 - Consolidate pours exceeding 12 inch (305 mm) in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred, but before plasticity is lost.
 6. Comply with TMS 602 Article 3.5 for grout keys as amended by CBC 2104A.1.3.8:
 - Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of 1 1/2 inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of 1/2 inch (12.7 mm) below the mortar joint. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25 mm) above reinforcing steel for each grout pour.
 7. Comply with TMS 602 Article 3.5 for grout placement as amended by CBC 2104A.1.3.9:
 - Additional grouting requirements:
 - Grout shall be placed by pumping or an approved alternate method before initial set of hardening occurs.
 - Grout shall be placed so that all spaces to be grouted do not contain voids.
 - Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.
 8. Comply with TMS 602 Article 2.3A & 2.3B for masonry unit materials as amended by CBC 2104A.1.3.11.1:
 - The depth of the bond beam channel below the top of the unit in hollow-unit masonry shall be 1 1/2 inches (38 mm) minimum and the width shall be 3 inches (76 mm) minimum.
 9. Comply with TMS 602 Article 3.5 for grout confinement as amended by CBC 2104A.1.3.11.2:
 - All cells shall be solidly filled with grout in reinforced hollow-unit masonry [OSHPD 1 & 4] and shall be constructed using single or double open-end units, except single open-end units shall be used at wall intersections, corners and similar conditions.
 - Exception: Reinforced hollow-unit masonry laid in running bond used for freestanding site walls or interior nonbearing non-shear wall partitions may be grouted only in cells containing vertical and horizontal reinforcement.
 - Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear grout space dimension of not less than that given in Section 2103A.3.1.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors approved by DSA to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections:
 - 1. Special inspections according to Level C in TMS 402/602:
 - a. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - b. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - c. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One (1) set of tests.
- D. Testing Frequency: One (1) set of tests for each 5,000 square feet (464 sq. m) of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for compressive strength per TMS 602 Article 1.4 B as amended by CBC 2105A.3:
 - 1. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on 3 successive working days and at least at 1-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. [DSA-SS] Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C270 with a valid evaluation report.
 - 2. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet of masonry wall area. They shall meet the minimum strength requirement given in ASTM C476/TMS 602, Section 2.2, or greater as specified.
 - 3. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.
 - 4. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.
 - 5. Exception: For nonbearing non-shear masonry walls not exceeding total wall height of 12 feet above top of foundation, mortar tests shall be permitted to be limited to those at the beginning of masonry work for each mix design.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019. Test grout for compressive strength per TMS 602 Article 1.4 B as amended by CBC 2105A.3:
 - 1. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on 3 successive working days and at least at 1-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in

accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. [DSA-SS] Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C270 with a valid evaluation report.

2. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet of masonry wall area. They shall meet the minimum strength requirement given in ASTM C476/TMS 602, Section 2.2, or greater as specified.
 3. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.
 4. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.
 5. Exception: For nonbearing non-shear masonry walls not exceeding total wall height of 12 feet above top of foundation, mortar tests shall be permitted to be limited to those at the beginning of masonry work for each mix design.
- H. Core Test (Shear Strength): Determine average unit shear value of masonry by testing masonry cores according to CBC 2105A.4:
1. Not less than two cores shall be taken from each building for each 5,000 square feet (465 m²) of the masonry wall area or fraction thereof. The approved agency shall perform or observe the coring of the masonry walls and sample locations shall be subject to approval of the registered design professional.
 2. Core samples shall comply with the following:
 3. Cored no sooner than 7 days after grouting of the selected area;
 4. Be a minimum of 3 3/4 inches in nominal diameter; and
 5. Sampled in such a manner as to exclude any masonry unit webs, mortar joint, or reinforcing steel. If all cells contain reinforcement, alternate core locations or means to detect void or delamination shall be selected by the registered design professional and approved by the building official.
 6. Visual examination of all cores shall be made by an approved agency and the condition of the cores reported as required by the California Administrative Code. Shear test both joints between the grout core and the outside wythes or face shell of the masonry 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. Core samples shall not be soaked before testing. Core samples to be tested shall be stored in sealed plastic bags or non-absorbent containers immediately after coring and for at least 5 days prior to testing. The average unit shear value for each pair of cores (4 shear tests) from each 5,000 square feet of wall area (or less) on the cross section of core shall not be less than 2.5 $\sqrt{f'_m}$ psi.
 7. All cores shall be submitted to an approved agency for examination, even where the core specimens failed during the cutting operation. The approved agency shall report the location where each core was taken, the findings of their visual examination of each core, identify which cores were selected for shear testing, and the results of the shear tests.
 8. Exceptions:
 9. Core sampling and testing is not required for nonbearing nonshear masonry walls, not exceeding a total wall height of 12 feet above top of foundation, built with single-wythe hollow unit concrete masonry that attaches opposite face shells using webs cast as single unit, when designed using an f'_m not exceeding 2,000 psi (13.79 MPa).
 10. An infrared thermographic survey or other nondestructive test procedures, shall be permitted to be approved as an alternative system to detect voids or delamination in grouted masonry in-lieu of core sampling and testing. [OSHPD 1 & 4] Infrared thermographic surveys or other nondestructive test procedures shall also include core tests with a minimum of two cores taken from each building for each 10,000 square

feet (930 m2) of the wall

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, damaged, or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning:
 - 1. After mortar is thoroughly set and cured, clean exposed masonry:
 - a. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - b. Test cleaning methods on sample wall panel; leave 1/2 of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - c. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - d. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - e. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 - f. Clean stone trim to comply with stone supplier's written instructions.

3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from site.
- B. Waste Disposal as Fill Material:
 - 1. Dispose of clean masonry waste, including excess or soil contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed:
 - a. Crush masonry waste to less than four inches (100 mm) in each dimension.
 - b. Mix masonry waste with at least two (2) parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31.
 - c. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- C. Masonry Waste Recycling: Return broken CMU not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove and legally dispose excess clean masonry waste that cannot be used as fill or otherwise recycled, and masonry waste.

END OF SECTION 04 22 00

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Field-installed shear connectors.
 - 3. Grout.
- B. Related Sections:
 - 1. Section 05 12 13 - Architecturally Exposed Structural Steel Framing for additional requirements for architecturally exposed structural steel.
 - 2. Section 05 31 00 - Steel Decking for field installation of shear connectors through deck.
 - 3. Section 01 40 00 - Quality Requirements for independent testing agency procedures and administrative requirements.
 - 4. Section 09 91 23 - Painting

1.03 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Product Test Reports: For the following:
 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 2. Direct-tension indicators.
 3. Tension-control, high-strength bolt-nut-washer assemblies.
 4. Shop primers.
 5. Nonshrink grout.

1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- B. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 341 and AISC 341s1.
 3. AISC 360.
 4. RCSC's "Specification for Structural Joints Using ASTM F3125 bolts."
 5. California Building Code, 2022 Edition
 6. CCR Title 24 Part 2

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.08 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M unless otherwise noted on details.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Grade B, Type E or S.
 1. Weight Class: As indicated on the Drawings.
- F. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F3125, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
 1. Finish: Hot-dip zinc coating.

2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 1. Finish: Plain
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 36 unless otherwise noted, straight.
 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
 4. Finish: Plain
- E. Headed Anchor Rods: ASTM F 1554, Grade 36 unless otherwise noted, straight.
 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
 4. Finish: Plain
- F. Threaded Rods: ASTM A 36 unless otherwise noted.
 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
 3. Finish: Plain
- G. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.03 PRIMER

- A. 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."
- B. Primer: Zinc Chromate. Primer selected shall be compatible with finish coats of paint. Coordinate selection of metal primer to be compatible with actual finish paint. Comply with California Air Resources Boards and Environmental Protection Agency Rules.

- C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20, ASTM A 780.

2.04 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 EXPOSED STRUCTURAL STEEL

- A. Exposed Structural Steel: All structural steel exposed to view shall meet the following requirements:
 - 1. All structural members exposed to view shall be straight and free of dents or other blemishes. The fabricator shall use special care to avoid bending, twisting, or otherwise distorting members during delivery.
 - 2. Members shall be plumb, level, and aligned to tolerances permitted for structural steel per AISC standards.
 - 3. Curved sections shall be bent to form smooth curves and shall be free of wrinkles, buckling, or other deformations. Fabricator shall increase member thickness as required to assure proper appearance.
 - 4. Member ends shall be notched and fitted as required for proper fit-up and welding.
 - 5. Provide ¼" flush fitting end caps at exposed ends of hollow members. Weld all around with partial pen butt weld and grind smooth.
 - 6. All welds shall be smooth and uniform. Grinding is not required except where clearances or fit of other components may necessitate, or when specifically shown on drawings or specified in these notes.
 - 7. The fabricator has the option to select which welds need to be field welds for erection purposes unless specifically shown on Drawings. All field welds shall be clearly shown on the shop drawings and will require the approval of the Structural Engineer.
 - 8. Remove all temporary erection bolts. Fill holes with weld metal and grind smooth.
 - 9. Fill holes in over-sized slots with weld metal and grind smooth.
 - 10. Grind all corners and edges of connection plates to provide straight smooth edges with eased corners.

2.07 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.08 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.09 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Cost of Testing and Inspection: Cost of testing and inspection of structural steel, except as specified hereunder and in Division 1, will be paid for by the Owner.
1. All transportation costs and per diem living costs for inspection at fabricator's plant further than 75 miles from the job site will be back-charged to the Contractor.
 2. It is assumed that all fabrication will take place in one shop location only. All additional inspection costs will be back-charged to the Contractor.
 3. All mill tests and costs or re-test of plain materials shall be at the expense of the Contractor.
 4. Costs of tests required due to Contractor's failure to provide steel identifiable in accordance with the indicated ASTM designation shall be at the expense of the Contractor.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

- D. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM F3125 Bolts."
- E. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate where indicated.

3. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect and Structural Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM F3125 Bolts."

- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 09 91 23 - Painting.

END OF SECTION

SECTION 05 12 13
ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

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 Architecturally Exposed Structural Steel (AESS):
 - 1. Requirements in Section 05 12 00: Structural Steel Framing also apply to AESS.
- B. Related Sections:
 - 1. Section 05 12 00: Structural Steel Framing.
 - 2. Section 05 50 00: Metal Fabrications.
 - 3. Section 09 90 00: Painting and Coating.

1.3 DEFINITIONS

- A. AESS: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.
- B. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.
- C. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.
- D. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents or that is indicated to receive intumescent mastic fireproofing.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS:
 - a. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - b. Include embedment drawings.
 - c. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
 - d. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate

- orientation of bolt heads.
 - e. Indicate exposed surfaces and edges and surface preparation being used.
 - f. Indicate special tolerances and erection requirements.
- B. Samples:
- 1. Submit samples of AESS to set quality standards for exposed welds:
 - a. Two (2) steel plates, 3/8 by eight (8) by four (4) inches, with long edges joined by a groove weld and with weld ground smooth.
 - b. Steel plate, 3/8 by eight (8) by eight (8) inches, with one end of a short length of rectangular steel tube, four (4) by six (6) by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.
 - c. Round steel tube or pipe, minimum eight inches (8") in diameter, with end of another round steel tube or pipe, approximately four inches (4") in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.
- C. Qualification Data: For installer and fabricator.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Mockups:
- 1. Build mockups of AESS to set quality standards for fabrication and installation:
 - a. Build mockup of typical portion of AESS as shown on Drawings.
 - b. Coordinate painting requirements with Section 09 90 00: Painting and Coating.
 - c. Coordinate high-performance coatings requirements with Section 09 96 00: High Performance Coatings.
 - d. Coordinate intumescent mastic fireproofing requirements with Section 07 81 23: Intumescent Fireproofing.
 - e. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Pre-Installation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration:
- 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies:
 - 1. Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers:
 - a. Finish: Mechanically deposited zinc coating.
- B. Corrosion-Resisting (Weathering Steel), Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: Type 3, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

2.2 FILLER

- A. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

2.3 PRIMER

- A. Primer: Comply with Section 09 90 00: Painting and Coating.
- B. Etching Cleaner for Galvanized Metal: MPI#25.
- C. Galvanizing Repair Paint: ASTM A780/A780M.
- D. Shop Primer for Galvanized Steel: MPI#26, cementitious galvanized metal primer.

2.4 FABRICATION

- A. Shop fabricate and assemble AECS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
- B. In addition to special care used to handle and fabricate AECS, comply with the following:
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
 - 2. Grind sheared, punched, and flame-cut edges of Category 1 AECS to remove burrs and provide smooth surfaces and edges.
 - 3. Fabricate Category 1 AECS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
 - 4. Fabricate Category 1 and Category 2 AECS with exposed surfaces free of seams to maximum extent possible.
 - 5. Remove blemishes by filling or grinding or by welding and grinding before cleaning, treating, and shop priming.
 - 6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
 - 7. Fabricate Category 1 AECS to the tolerances specified in AISC 303 for steel that is designated AECS.
 - 8. Fabricate Category 2 and Category 3 AECS to the tolerances specified in AISC 303 for steel that is not designated AECS.
 - 9. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for Category 1 AECS.
- C. Curved Members:
 - 1. Fabricate indicated members to curved shape by rolling to final shape in fabrication shop:
 - a. Distortion of webs, stems, outstanding flanges, and legs of angles shall not be

- visible from a distance of 20 feet under any lighting conditions.
- b. Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch.
- D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch for Category 1 AESS.
- E. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- F. Cleaning Corrosion-Resisting Structural Steel: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- G. Holes:
 - 1. Provide holes required for securing other work to structural steel and for other work to pass through steel members:
 - a. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - b. Baseplate holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - c. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

- A. High-Strength Bolts:
 - 1. Shop install high-strength bolts according to RCSC's Specification for Structural Joints Using ASTM F3125 Bolts for type of bolt and type of joint specified:
 - a. Joint type: Snug tightened or slip critical as indicated.
- B. Weld Connections:
 - 1. Comply with AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:
 - a. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
 - b. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
 - c. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where Category 1 AESS is exposed to weather.
 - d. Provide continuous welds of uniform size and profile where Category 1 AESS is welded.
 - e. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch (0") for Category 1 and Category 2 AESS.
 - f. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch (0") for Category 1 and Category 2 AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
 - g. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
 - h. At locations where welding on the far side of an exposed connection of Category 1 and Category 2 AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
 - i. Make fillet welds for Category 1 and Category 2 AESS oversize and grind to uniform profile with smooth face and transition.
 - j. Make fillet welds for Category 1 and Category 2 AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to

correct unacceptable work.

2.6 GALVANIZING

- A. Hot-Dip Galvanized Finish:
 - 1. Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M:
 - a. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - b. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - c. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of two inches (2").
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
- B. Surface Preparation for Non-Galvanized Steel:
 - 1. Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - a. SSPC-SP 2 Hand Tool Cleaning.
 - b. SSPC-SP 3 Power Tool Cleaning.
 - c. SSPC-SP 7/NACE No. 4 Brush-off Blast Cleaning.
 - d. SSPC-SP 14/NACE No. 8 Industrial Blast Cleaning.
 - e. SSPC-SP 11 Power Tool Cleaning to Bare Metal.
 - f. SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning.
 - g. SSPC-SP 10/NACE No. 2 Near-White Blast Cleaning.
 - h. SSPC-SP 5/NACE No. 1 White Metal Blast Cleaning.
 - i. SSPC-SP 8 Pickling.
- C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Priming:
 - 1. Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces:
 - a. Prime paint corners, crevices, bolts, welds, and sharp edges.
 - b. Apply two (2) coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 EXECUTION

3.1 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

3.2 FIELD CONDITIONS

- A. Field Measurements: Where AECS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

3.3 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements:
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Examine AECS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AECS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated:
 - 1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
 - 2. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.5 ERECTION

- A. Set AECS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360:
 - 1. Erect Category 1 AECS to the tolerances specified in AISC 303 for steel that is designated AECS.
 - 2. Erect Category 2 and Category 3 AECS to the tolerances specified in AISC 303 for steel that is not designated AECS.
- B. Do not use thermal cutting during erection unless approved by Architect.

3.6 FIELD CONNECTIONS

- A. High-Strength Bolts:
 - 1. Install high-strength bolts according to RCSC's Specification for Structural Joints Using ASTM F3125 Bolts for type of bolt and type of joint specified:
 - a. Joint type: Snug tightened or slip critical as indicated.
 - b. Orient bolt heads in same direction for each connection and to maximum extent possible in same direction for similar connections.
- B. Weld Connections:
 - 1. Comply with requirements in "Weld Connections" paragraph in "Shop Connections" article:
 - a. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AECS.
 - b. Remove erection bolts in Category 1 and Category 2 AECS, fill holes, and grind smooth.

- c. Fill weld access holes in Category 1 and Category 2 AESS and grind smooth.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Section 05 12 00: Structural Steel Framing. The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.8 REPAIRS AND PROTECTION

- A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- C. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces:
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- D. Touchup Painting: Cleaning and touchup painting are specified in Section 09 90 00: Painting and Coating.
- E. Touchup Priming: Cleaning and touchup priming are specified in Section 09 96 00: High Performance Coatings.

END OF SECTION 05 12 13

SECTION 05 31 00 STEEL DECKING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
 - 2. Supplementary framing for openings up to and including 18 inches.
 - 3. Bearing plates and angles.
 - 4. Composite floor deck.
 - 5. Composite roof deck.
- B. Related Requirements:
 - 1. Section 03 30 00: Cast-in-Place Concrete.
 - 2. Section 05 12 00: Structural Steel Framing.
 - 3. Section 05 50 00: Metal Fabrications.
 - 4. Section 09 91 23: Painting.
- C. Reference Standards:
 - 1. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
 - 2. ASTM A510/A510M Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.
 - 3. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 4. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 5. AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
 - 6. FM 1-28 Wind Design.
 - 7. FM 1-29 Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System.
 - 8. ICC-ES AC43 Acceptance Criteria for Steel Deck Roof and Floor Systems.
 - 9. ICC-ES AC70 Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements.
 - 10. IAS AC172 Accreditation Criteria for Fabricator Inspection Programs for Structural Steel.
 - 11. SDI (DM) Publication No.31, Design Manual for Composite Decks, Form Decks, and Roof Decks.

1.3 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings:
 - 1. Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:

- a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

1.4 SUBMITTALS

- A. See Section 01 33 00: Submittal Procedures.
- B. Product Data:
 1. For each type of deck, accessory, and product indicated:
 - a. Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Shop Drawings:
 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- D. Welding Certificates.
- E. Product Certificates: For each type of steel deck.
- F. Product Test Reports:
 1. For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - a. Power-actuated mechanical fasteners.
- G. Evaluation Reports: For steel deck, from UES.
- H. Field Quality-Control Reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M "Structural Welding Code - Sheet Steel."
- C. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.
- D. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation:
 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Steel Deck:
 - 1. Verco Decking Inc; www.vercodeck.com.
 - 2. Substitutions: See Section 01 60 00: Product Requirements.

2.2 STEEL DECK

- A. Roof Deck - Non-composite type, steel sheet with plain vertical flute faces
 - 1. Galvanized steel sheet: ASTM A653/A653M, structural steel (SS) Grade 50, with G90/Z275 galvanized coating.
 - 2. Minimum base metal thickness: As indicated on the drawings
 - 3. Nominal height: As indicated on the drawings
 - 4. Profile: As indicated on the drawings
 - 5. Side joints: As indicated on the drawings

2.3 COMPOSITE FLOOR DECK

- A. Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized-steel sheet: ASTM A 653/A 653M, structural steel (SS), Grade 50, G60 zinc coating.
 - 2. Galvanized and shop-primed steel sheet: ASTM A 653/A 653M, structural steel (SS), Grade 50, zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray baked-on, rust-inhibitive primer.
 - 3. Profile depth: As indicated.
 - 4. Design uncoated-steel thickness: As indicated on Drawings.
 - 5. Span condition: As indicated on Drawings.

2.4 COMPOSITE ROOF DECK

- A. Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized-steel sheet: ASTM A 653/A 653M, structural steel (SS), Grade 50, G60 zinc coating.
 - 2. Galvanized and shop-primed steel sheet: ASTM A 653/A 653M, structural steel (SS), Grade 50, zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray baked-on, rust-inhibitive primer.
 - 3. Profile depth: As indicated.
 - 4. Design uncoated-steel thickness: As indicated on Drawings.
 - 5. Span condition: As indicated on Drawings.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Bearing Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.

- C. Fasteners: As indicated on drawings
- D. Side-Lap Fasteners: As indicated on drawings
- E. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- F. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with three-inch-wide (3") flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- L. Galvanizing Repair Paint: ASTM A780/A780M.
- M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.
- N. Sheet Metal Deck Accessories: Metal closure strips and cover plates, 12 gage, 0.1017 inch thick sheet steel; of profile and size as indicated; finished same as deck.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions prior to beginning work:
 - 1. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.

- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks:
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. On steel supports provide minimum two inch (2") bearing.
- J. Clinch lock seam side laps.
- K. Weld deck in accordance with AWS D1.3/D1.3M.
- L. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.3 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld diameter: 5/8 inch, visible.
 - 2. Weld spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening:
 - 1. Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
 - a. Fasten with a minimum of 1-1/2-inch-long welds.
- C. End Bearing:
 - 1. Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:
 - a. End joints: Lapped two inches (2") minimum.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.

- C. Prepare test and inspection reports.

3.5 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Painting:
 - 1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint:
 - a. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - b. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09 91 23: Painting.

END OF SECTION 05 31 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Metal ladders.
 - 2. Pipe, downspout guards.
 - 3. Handrails and brackets.
 - 4. Mechanical Curbs.
 - 5. Accessories necessary for a coordinated and complete installation.
- B. Related Sections:
 - 1. Section 03 30 00: Cast in Place Concrete.
 - 2. Section 09 21 16: Gypsum Board Assemblies.
 - 3. Section 09 24 00: Cement Plastering.
 - 4. Section 09 91 23: Painting.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders and landings capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Thermal Movements:
 - 1. Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
 - a. Temperature change (range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.4 SUBMITTALS

- A. Product Data: Submit data for miscellaneous metal fabrications and paint, coatings, and grout accessories.
- B. Shop Drawings:
 - 1. Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items:
 - a. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding Certificates.

- D. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Building Code - comply with applicable provisions of the CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - a. CBC Section 11B-504 where applicable.
 2. Welding - qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M Structural Welding Code – Steel.
 - b. AWS D1.2/D1.2M Structural Welding Code - Aluminum.
 - c. AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
 - d. AWS D1.6/D1.6M Structural Welding Code - Stainless Steel.
 - e. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Fabricator/Installer Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project for a minimum of five (5) years, with a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle to prevent any type of damage to the fabricated work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276, Type 304.
- E. Rolled Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- F. Rolled Stainless Steel Floor Plate: ASTM A793.
- G. Abrasive Surface Floor Plate:
1. Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) IKG Industries, a division of Harsco Corporation.
 - 2) SlipNOT Metal Safety Flooring; W.S. Molnar Company.

- H. Steel Tubing: ASTM A500/A500M, cold formed steel tubing.
- I. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- J. Zinc Coated Steel Wire Rope - ASTM A741:
 - 1. Wire rope fittings: Hot dip galvanized steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- K. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- L. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- M. Aluminum Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- N. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- O. Fasteners:
 - 1. Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required:
 - a. Provide stainless steel fasteners for fastening stainless steel.
 - b. Steel bolts and nuts: Regular hexagon head bolts, ASTM A307, Grade A with hex nuts, ASTM A563 and, where indicated, flat washers.
 - c. Steel bolts and nuts: Regular hexagon head bolts, ASTM A325, Type 3 with hex nuts, ASTM A 563, Grade C3 and, where indicated, flat washers.
 - d. Stainless steel bolts and nuts: Regular hexagon head annealed stainless steel bolts, ASTM F593 with hex nuts, ASTM F594 and, where indicated, flat washers; alloy.
 - e. Anchor bolts - ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 and, where indicated, flat washers:
 - 1) Hot dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
 - f. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - g. Post installed anchors - per Drawings:
 - 1) Material for interior locations: Carbon steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2) Material for exterior locations and where stainless steel is indicated: ASTM F593, and nuts, ASTM F594.
 - h. Cast-in-place anchors in concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F2329.
- P. Miscellaneous Materials:
 - 1. Shop primer for ferrous metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Provide 10-99 (red) or 10-09 (gray) by Tnemec Company.
 - 2. Universal shop primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
 - 3. Water based primer: Emulsion type, anticorrosive primer for mildly corrosive

environments that is resistant to flash rusting when applied to cleaned steel and compatible with topcoat.

4. Shop primer for galvanized steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
5. Galvanizing repair paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20. Provide Tneme-Zinc 90-97 by Tnemec Company.
6. Bituminous paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187.
7. Non-shrink, nonmetallic grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
8. Concrete materials and properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8 inch with at least 95 percent passing a 3/8-inch sieve and not more than ten percent (10%) passing a No. 8 sieve. Fill shall be proportioned to provide a minimum 28-day compressive strength of 3,000 psi (20 MPa).

2.2 FABRICATION

A. Shop Assembly:

1. Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation:
 - a. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 - b. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - c. Form exposed work with accurate angles and surfaces and straight edges.
 - d. Weld corners and seams continuously to comply with the following:
 - 1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2) Obtain fusion without undercut or overlap.
 - 3) Remove welding flux immediately.
 - 4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - e. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
 - f. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - g. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
 - h. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - i. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches (3.2 mm by 38 mm), with a minimum six-inch (150 mm) embedment and two-inch (50 mm) hook, not less than eight inches (200 mm) from ends and corners of units and 24 inches (600

- mm) o.c., unless otherwise indicated.
- j. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.
- B. Miscellaneous Framing and Supports:
- 1. Provide steel framing and supports necessary to complete the work and that are not a part of the structural framework, including, but not limited to, framing and supports for overhead lobby door frames, sliding doors, countertop and vanities, ceiling hung toilet compartments, tube framing for partial height walls, and mechanical and electrical equipment:
 - k. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction. Cut, drill, and tap units to receive hardware, hangers, and similar items:
 - 1) Fabricate units from slotted channel framing where indicated.
 - 2) Furnish inserts for units installed after concrete is placed.
- C. Shelf Angles:
- 1. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19 mm) bolts, spaced not more than six inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated:
 - a. Provide mitered and welded units at corners.
 - b. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately two inches (50 mm) larger than expansion or control joint.
 - c. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
 - d. Galvanize and prime shelf angles located in exterior walls.
 - e. Prime shelf angles located in exterior walls with zinc rich primer.
 - f. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.3 LADDERS

- A. Ladders - Comply with ANSI A14.3. For elevator pit ladders, comply with ASME A17.1/CSA B44:
- 1. Steel ladders:
 - a. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
 - b. Siderails: Continuous, 1/2 inch by 2-1/2-inch (12.7 mm by 64 mm) steel flat bars, with eased edges.
 - c. Rungs:
 - 1) 3/4-inch (19 mm) diameter steel bars.
 - 2) Fit rungs in centerline of siderails; plug weld and grind smooth on outer rail faces.
 - 3) Provide nonslip surfaces on top of each rung, either by coating rung with aluminum oxide granules set in epoxy resin adhesive or by using a type of manufactured rung filled with aluminum oxide grout.
 - 4) Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung:
 - 5) Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a) Harsco Industrial IKG, a division of Harsco Corporation.
 - b) SlipNOT Metal Safety Flooring; W.S. Molnar Company.
 - d. Provide platforms as indicated fabricated from welded or pressure locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2

- inch (12 mm) in least dimension.
- e. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
- f. Galvanize ladders, including brackets and fasteners.

2.4 MISCELLANEOUS STEEL TRIM

- A. Miscellaneous Steel Trim:
 - 1. Unless otherwise indicated, fabricate units from structural 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:
 - a. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work:
 - 1) Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction, spaced not more than six inches (150 mm) from each end, six inches (150 mm) from corners, and 24 inches (600 mm) o.c.
 - 2) Galvanize miscellaneous steel trim.

2.5 PIPE, DOWNSPOUT GUARDS

- A. Fabricate pipe, downspout guards from 3/8 inch (9.5 mm) thick by 12 inch (300 mm) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with two inch (50 mm) clearance between pipe and pipe guard. Drill each end for two (2) 3/4-inch (19 mm) anchor bolts.
- B. Galvanize and prime pipe, downspout guards.

2.6 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).
- D. Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).

2.7 FINISHES

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.8 STEEL AND IRON FINISHES

- A. Galvanizing:
 - 1. Hot dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products:
 - a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- D. Preparation for Shop Priming:
 - 1. Prepare surfaces to comply with requirements indicated below:
 - a. Exterior items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Items indicated to receive zinc-rich primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - c. Items indicated to receive primers specified in Section 09 96 00: High-Performance Coatings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - d. Other items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming:
 - 1. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting:
 - a. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- F. Stainless Steel Finishes:
 - 1. Remove tool and die marks and stretch lines, or blend into finish:
 - a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - b. Bright, directional polish: No. 4 finish.
 - c. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.9 EXPANDED METAL GRATINGS

- A. Provide expanded metal gratings in material, finish, style, size, thickness, weight, and type indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads. Manufacturer - Indiana Grating Inc. 212 W. Douglas St, Martinsville IN 46151. Grates to comply with CBC 11B-404, for accessible route of travel:
 - 1. Material: Steel
 - 2. Steel finish: Galvanized.
 - 3. Style designation: Light Duty Welded Steel Grating, see Drawings for details.

PART 3 EXECUTION

3.1 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

3.2 FIELD CONDITIONS

- A. Field Measurements:
 - 1. Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication:
 - a. Established dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - b. Provide allowance for trimming and fitting at site.

3.3 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation, with edges and surfaces level, plumb, true, and free of rack, and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding:
 - 1. Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection:
 - 1. Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - a. Cast aluminum: Heavy coat of bituminous paint.
 - b. Extruded aluminum: Two (2) coats of clear lacquer.

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on shop drawings.
- B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.5 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.
- B. Maximum Offset from True Alignment: 1/4 inch (6mm).
- C. Maximum Out of Position: 1/4 inch (6mm).

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces:
 - a. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 23: Painting.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 05 52 13

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.03 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.02 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- E. Expanded Metal: ASTM F 1267, Class 1 (uncoated).
 - 1. Style Designation: [3/4 number 13] [1-1/2 number 10] <Insert designation>.
- F. Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M.
- G. Woven-Wire Mesh: Intermediate-crimp, **square** pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

2.03 MISCELLANEOUS MATERIALS

- A. Fasteners: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
- B. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- D. 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."
- E. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Shop Primers: Provide primers that comply with Section 09 91 23 Painting.
- H. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- I. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

2.04 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- B. Form work true to line and level with accurate angles and surfaces.
- C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 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 flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- D. Form changes in direction by bending.
- E. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.
- F. Close exposed ends of railing members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers to transfer loads through wall finishes.
- I. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from same metal as railings in which they are installed, with pattern as indicated on Drawings.
- J. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into metal channel frames. Make wire mesh and frames from same metal as railings in which they are installed, with wires horizontal and vertical.

2.05 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 3. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 4. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- D. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Anchor posts in concrete by inserting into formed or core-drilled holes and grouting annular space.
- D. Anchor posts to metal surfaces by welding.
- E. Attach railings to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
- F. Secure wall brackets and railing end flanges to building construction as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 2. For hollow masonry anchorage, use toggle bolts.
 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.02 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Included: Provide all rough carpentry including all wood, nails, bolts, screws, framing, anchors and other rough hardware, and all other items needed for rough and finish carpentry in this work, but not specifically described in other sections of these specifications.
- B. Related Requirements:
 - 1. 03 30 00 - Cast In Place Concrete
 - 2. 06 20 00 - Finish Carpentry
 - 3. 06 40 00 - Architectural Woodwork

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with all pertinent provisions of the following codes and standards:
 - 1. Federal Specifications (Fed. Spec.)
 - a. FF-B-561C Bolts, (Screw), Lag
 - b. FF-B-588C(1) Bolt, Toggle: and Expansion Sleeve, Screw
 - c. FF-N-105B(3) Nails, Brads, Staples, Spikes, Wire, Cut and Wrought
 - d. FF-P-395B Pin, Drive, Guided; and Pin, Drive Powder Actuated
 - e. QQ-Z-32C Zinc Coated, Electro Deposited,
- B. Requirements for:
 - 1. U.S. Department of Commerce Product Standards:
 - a. PS 1 Construction and Industrial Plywood
 - b. PS 20 American Softwood Lumber Standard
 - 2. American Society for Testing and Materials (ASTM) Publications:
 - a. A307 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - 3. American Wood Preservers' Association (AWPA) Publication:
 - a. C2 Standard for the Preservative Treatment of Lumber, Timber, Bridge Ties, and Mine Ties by Pressure Treatment
 - b. Standard for the Preservative Treatment of Plywood by Pressure Treatment

- c. M4-77 Standard for the Care of Preservative Treated Wood Products
- 4. American Forest & Paper Association (AFPA) Publications:
 - a. 2018 Edition National Design Specification for Wood Construction and Supplement, Design Values for Wood Construction (as adopted by 2022 CBC).
- 5. Redwood Inspection Service (RIS) Publication: Standard Specifications for Grades of California Redwood Lumber, April 1989 Edition.
- 6. International Conference of Building Officials (ICBO) Publication & State of California:
 - a. California Building Code Standards, 2022 Edition
 - b. California Building Code, 2022 Edition
- 7. West Coast Lumber Inspection Bureau (WCLIB) Publication: Standard Grading Rules for West Coast Lumber, No. 17, September 1, 1991 Edition (Rev. 1993)
- 8. Western Wood Products Association (WWPA) Publication: Standard Grading Rules for Western Lumber, January 1, 1988.
- 9. Title 24, Part 2, California Code of Regulations.
- C. Conflicting Requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these specifications, the provisions of the more stringent shall govern.
- D. Qualifications of Personnel
 - 1. Throughout progress of the work of this section, provide at least one person thoroughly familiar with the specification requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this section.
 - 2. In actual installation of the work of this section, use adequate numbers of skilled workmen to ensure installation in accordance with the approved design and approved recommendations of the manufacturer of the material which is being installed or applied.

1.03 ACTION SUBMITTALS

- A. Retain only the most common and essential submittals and delete the rest.
- B. General: Make submittals in accordance with requirements of the General Conditions.
- C. Pneumatically-Driven Fasteners: Submit manufacturer's literature and installation instructions and one sample for review by the Architect.
- D. Framing Devices: Submit manufacturer's literature describing dimensions, materials and load carrying capacities for review by the Architect.

- E. Powder Actuated Fasteners: Submit manufacturer's literature describing installation instructions and load carrying capacity for review by the Architect.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation, and to protect the work and materials of all other trades.
- B. Replacement: In the event of damage, immediately make all repairs and replacements necessary and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GRADING AND MARKING

- A. Framing Lumber: Grade and grade-mark lumber in accordance with the following standards:
 - 1. Douglas Fir-Larch: WCLIB or WWP
 - 2. Redwood: RSI
 - 3. Exposed Structural Members: (Glu-Lam excepted) Manual of Millwork, Woodwork Institute of California, 1978, (MM-WIC-78).
 - 4. Exceptions: The provisions of WCLIB paragraph 2b and WWP Section 5.6 which permits five percent (5%) of the material to fall below grade shall not apply to structural framing members. Structural framing members which have permissible grade characteristics or defects in such combination as to affect the serviceability of the member shall be rejected.
- B. Plywood: Legibly identified with appropriate grade trademark of American Plywood Association. Plywood shall conform to requirements of Product Standard PS1. The outer plies of sanded or finished plywood shall be not less than 95 percent of the thickness required at the time of lay-up prior to sanding. Do not incorporate improperly or illegibly identified plywood into the work.
- C. Preservative Treated Lumber and Plywood: Each piece of preservative treated lumber or plywood shall be labeled with a permanent mark indicating conformance with the applicable AWP standard. The label shall be an approved AWP quality mark or that of an ALSC (American Lumber Standards Committee) approved independent inspection agency that maintains continuing control, testing, and inspection over the quality of the product.
- D. Oriented Strand Board (OSB): Legibly identified with appropriate grade trademark of American Plywood Association. OSB shall conform to the requirements of Product Standard PS 2. Do not incorporate improperly or illegibly identified OSB into the work.

2.02 MATERIALS

- A. Lumber: Surfaced four sides, except when otherwise required. Sizes of surfacing of lumber shall conform to PS 20 for dressed sizes of yard and structural lumber. Sizes of framing lumber and board lumber indicated on the drawings and specified hereinafter are given by nominal sizes, unless otherwise specified or indicated. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. To facilitate approximate equilibrium with average local atmospheric moisture conditions, lumber shall have been air seasoned for not less than 30 days, however, moisture content shall not exceed 19% when incorporated into the work. Material shall be kiln-dried when specifically noted or when customary practice requires such procedure. The following designation of materials, i.e. 'JOISTS AND PLANKS', 'POSTS AND TIMBERS', etc., is not intended to limit the use to such elements of the structure. Except as otherwise noted on the drawings, dimension lumber and boards shall be graded as specified in the following subparagraphs. Boxed heart material will not be permitted.
1. Light Framing: General Use: Douglas Fir-Larch (2" to 4" thick, 2" to 6" wide), "No. 1" - LIGHT FRAMING, Paragraph 122b WCLIB or Section 40.11 WWP.
 2. Joists and Planks: General Use: Douglas Fir-Larch (2" to 4" thick, 5" and wider), "NO. 1" STRUCTURAL JOISTS AND PLANKS, Paragraph 123b, WCLIB or Section 62.11 WWP, except that 2X12's shall be No. 1 or better Douglas Fir-Larch.
 3. Beams and Stringers: General Use: Douglas Fir-Larch (5" and thicker), "NO.1" BEAMS AND STRINGERS, Paragraph 130b, WCLIB or Section 70.11 WWP.
 4. Posts and Timbers: General Use: Douglas Fir-Larch (4"x 4" and larger), NO.1" POSTS AND TIMBERS, Paragraph 131b, WCLIB or Section 80.00 WWP.
 5. Boards: (Nominal sizes up to 1-1/2" thick, 2" and wider), "CONSTRUCTION" - BOARDS, 188b, WCLIB.
 6. Sill Plates: Bearing on concrete: Douglas Fir: minimum no. 2, pressure treated,. Use No. 1 Grade if 2"x 5" or larger.
- B. Plywood
1. Provide plywood in accordance with following listed uses, unless otherwise designated on drawings.
 2. Each panel shall bear the appropriate symbol marking as hereinafter specified, however panel thickness, identification index or specie group shall be as required on the drawings.

2.03 TYPICAL APPLICATIONS

- A. Roof Sheathing not exposed to weather
- B. Signs, mounting panels and similar uses.

C. Rough Hardware

1. Fasteners: Nails, spikes, screws, lag screws, nuts, bolts and similar fastenings of the types and sizes required by the drawings or as otherwise indicated, sufficient to properly draw and secure members in place. Fastenings exposed to weather, and at other conditions which subject the fastenings to corrosion, shall be copper, stainless steel, hot-dip galvanized or other non-corrosive metal as indicated on the drawings or required by the specifications. In the absence of specific requirements elsewhere, the fastenings shall be hot-dip galvanized at such locations. Fastenings, not indicated or specified, shall conform to the requirements of "National Design Specification for Stress Grade Lumber and its Fastenings", of the American Forest & Paper Association
 - a. Common Nails and Spikes: Flat head, diamond point, smooth, bright, Fed. Spec. FF-N-105B.
 - b. Mechanically deformed (Annular): Threaded or ring shank, Stronghold, Independent Nail and Packing Co.
 - c. Concrete Nails: Flat countersunk head, diamond point, quench hardened steel.
 - d. Finishing Nails: Brad head, diamond point, smooth or mechanically deformed, Fed. Spec. FF-N-105B.
 - e. Wood Screws: Fed. Spec. FF-S-111D.
 - f. Bolts and Nuts: Steel machine bolts and nuts, ASTM A-307.
 - g. Lag Screws: Fed. Spec. FF-B-561C.
 - h. Toggle Bolts: Fed. Spec. FF-B-588.
2. Pneumatically Driven Fasteners: Pneumatically driven staples, nails, or allied fasteners shall be used only when reviewed by the Architect. Submit samples and manufacturer's installation instructions.
3. Plywood Joint Clips: H-shaped fastening device, extruded aluminum alloy, 1-3/16" long, 3/4" wide, to accommodate thickness of plywood required by structural drawings, Plyclip, Plywood Research Foundation, Tacoma, Washington or approved equal.
4. Framing Devices: Framing anchors, joist hangers and similar devices, Simpson Company, San Leandro, California or equivalent.
5. Powder Actuated Fasteners: The fasteners shall have a dome shaped head, a .145 inch minimum diameter smooth shank and shall have sufficient length to penetrate the concrete 1-1/8 inches. Fasteners shall be installed with a 7/8 inch minimum diameter, 14 gage steel disc under the fastener head. Fasteners shall be manufactured from AISI 1062 or 1065 steel tempered to a minimum core hardness of 50 to 57 Rockwell hardness and shall possess the following minimum properties:
 - a. Tensile Strength = 270,000 psi
 - b. Shear Strength = 162,000 psi
6. The fasteners shall be zinc plated with a minimum thickness of .003 inches then zinc chromate passivated. Fasteners shall meet requirements of Fed. Spec. FF-P-395B and QQ-Z-325C, Type II, Class 3.

- D. Adhesive: Contact adhesive, Fed. Spec. MMM-A-130B.
- E. Mortar Bedding of Sill Plates
 - 1. Dry-Pack Mortar: One part Portland cement to 2 parts fine sand.
 - 2. Non-Shrink Mortar: Ready to use metallic aggregate product requiring only the addition of water at the job site. Product shall have the following characteristics.
 - a. Be capable of producing mortar bed material having no drying shrinkage or settlement at any age.
 - b. Compressive strength of mortar (2" cubes) shall be not less than 5,000 psi at age seven days and 7,500 psi at age 28 days.
- F. Bridging: Use one of the following:
 - 1. Two crossed wood pieces, 2" x 3" minimum size.
 - 2. Full depth 2" thick solid blocking.
 - 3. Approved metal cross bridging.
- G. Other Materials: All other materials not specifically described, but required for complete and proper performance of the work as indicated on the drawings shall be new, suitable for intended use, and subject to review of the Architect.

2.04 RE-USE OF MATERIALS

- A. Wood products previously used on this project for forming or other temporary uses may be incorporated into the work as concealed blocking, backing, or similar miscellaneous uses when the material has been cleaned, is equivalent in all respects to new material and has been reviewed by the Architect.

2.05 PRESERVATIVE TREATMENT

- A. Pressure Treatment: Wood framing and plywood shall be pressure treated with a preservative when used under the following conditions:
 - 1. Foundation plates or sills and sleepers on a concrete slab which is in direct contact with earth.
 - 2. Sills which rest on concrete or masonry foundations.
 - 3. Wood in direct contact with earth.
 - 4. Posts or columns placed directly on concrete or masonry.
 - 5. Wood nailers embedded in concrete or masonry.
- B. Preservatives
 - 1. Treatment shall conform to AWPB C-2 for lumber and AWPB C-9 for plywood.
- C. Field Handling

1. Handle treated lumber and treat penetration damage in accordance with AWPA M-4.
2. When treating lumber or plywood with a water borne salt, dry to a moisture content of 19% or less after treatment.

2.06 FIRE RETARDANT TREATMENT

- A. Fire Retardant Treatment: Wood framing and plywood (as indicated in drawings) shall be treated with Pyro-Guard as manufactured by Hoover Treated Wood Products or approved equal.
- B. Requirements:
 1. Treated wood shall have a flame spread rating of 25 or less (Class A) and a smoke developed index of 450 or less when tested in accordance with ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Burning Materials"
 2. Structural performance of fire retardant wood shall meet requirements of ASTM D5664 for lumber. ASTM D 5516 and ASTM D 6305 for plywood.
 3. Treated wood used in structural applications shall be installed in accordance with ESR-1791.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 WORKMANSHIP

- A. General: Carpentry work shall produce joints true, plumb, level, tight and well nailed, or fastened as indicated, with all members assembled in accordance with the drawings and with all pertinent codes and regulations.

3.03 FRAMING

- A. General
 1. In addition to all framing operations customary to fabrication and erection indicated on the drawings, install all backing required for work of other trades.
 2. Do not shim sills, joists, short studs, trimmers, headers, lintels, or other framing components.
 3. Set all horizontal or sloped members with crown up.
 4. Do not splice individual framing members between supports.
- B. Bearings

1. Make all bearing full unless otherwise indicated on the Drawings.
2. Finish all bearing surfaces on which structural members are to rest so as to provide positive and even support. Where framing members slope, cut or notch as required to provide uniform bearing surface.
3. Provide solid blocking for joists and rafters at all bearings.

C. Notching and Boring

1. Do not notch, bore, or cut members for pipes, ducts, conduits for other reasons except as shown on the Drawings or as specifically reviewed in advance by the Architect.

D. Blocking

1. Install all blocking required to support all items of finish and to cut-off all concealed draft openings, both vertical and horizontal.
2. Fire-blocking, when of wood, shall be two inches (nominal) in thickness by the full width of the opening being blocked.
3. Fire-block in the following specific locations:
 - a. In all stud walls at ceiling and floor levels.
 - b. In all stud walls, including stud spaces, so that the maximum dimension of each concealed space is not more than eight feet.
 - c. All other location where openings could afford passage for rodents or flames.

E. Bridging

1. Required Locations
 - a. In roof rafter and ceiling joist spans where the depth of the member is more than 8" deep and the spacing is 32" or less.
2. Spacing: The spacing between adjacent bridging members and between the bearing and a bridging member shall not exceed the following:

MEMBER	MAXIMUM SPACING
Roof Rafters	7'-3"
Ceiling Joists	10'-0"

3. Place bridging at midspan where only one set of bridging is required.
4. Installation: The lower ends of the cross bridging shall be driven up and nailed after the roof has been nailed.

- F. Sill Plates: Sill plates bearing on concrete or masonry shall be accurately aligned and leveled to the required elevation shall be completely bedded in 1/2 inch Portland cement mortar, except for non-bearing walls on true and level floors, so as to obtain a. Plates shall be secured with anchor bolts in accordance with the structural details. Washers shall be placed between the plate and the nut. Nuts shall be tightened immediately prior to becoming inaccessible.

G. Stud Walls and Partitions

1. Studs: Make all studs single length, unspliced.
2. Corners and Intersections: Unless otherwise indicated on the Drawings, frame all corners and intersections with three or more studs and all required bearing for wall finish.
3. Spacing: Unless otherwise noted, studs shall be spaced 16" o.c.

3.04 INSTALLATION OF WOOD PANEL SHEATHING

A. General

1. Protect all sheathing from moisture by use of waterproof coverings until the plywood has in turn been covered so as to be protected.
2. Install in accordance with the requirements of the drawings and notations thereon.
3. Allow 1/16 inch spacing at panel ends and 1/8 inch spacing at panel edges.
4. Install sheathing joints to be centered on its supporting members.

B. Roof Sheathing

1. Install with face grain perpendicular to supports and continuous over two or more spans with end joints staggered.
2. No panel less than 24 inches wide shall be used.

C. Wall Sheathing

1. Wall sheathing may be installed either horizontally or vertically. Stagger end joints.
2. Wood blocking shall be provided at horizontal joints not otherwise supported.
3. No panel less than 24 inches wide shall be used.

3.05 FASTENING

A. Nailing

1. Use only common wire nails or spikes of the size required.
2. The use of machine nailing for plywood is subject to a satisfactory jobsite demonstration review by the Architect. Approval is subject to continued satisfactory performance. If requirements for nailhead penetration and nail edge distance requirements are not met, machine nailing shall be discontinued and the Architect and Structural Engineer notified of the non-conforming work.
3. Nails in sheathing shall not be overdriven to the extent that nailheads penetrate the face ply more than the thickness of the nail head.
4. The spacing center to center of nails shall not be less than the required penetration. Edge or end distances shall not be less than one-half the required penetration. The required penetration is 10 nail diameters for Douglas-Fir lumber.

5. Do all nailing without splitting the wood. Prebore to a diameter smaller than the nail when required to avoid splitting. Replace all split members.
 6. Prebored holes will be required for all nails 20d and larger; or where nailing tends to split the wood.
- B. Bolting: Drill holes 1/16 inches larger in diameter than the bolts being used. Drill straight and true from one side only. Bolts shall be provided with plate washers or malleable iron washers. All nuts shall be turned up and made tight at the time of installation and again immediately before being enclosed with other fixed materials or at the completion of the job. Edges of square washers used at exposed locations shall be installed level and plumb.
- C. Lag-Screws
1. The threaded portion of the lag screw shall be inserted into its lead hole by turning with a wrench.
 2. Soap or other lubricant shall be used on the screw or in the lead hole to facilitate insertion and prevent damage to the screw.
 3. The lead hole for the shank shall have the same diameter as the shank, and the same depth as the unthreaded shank.
 4. The lead hole for the threaded portion shall have a diameter equal to 60 to 75 percent (use larger figure for larger bolts) of the shank diameter and a length equal to at least the length of the threaded portion.
 5. Washers shall be provided under the heads of lag screws that bear on wood.
- D. Wood Screws:
1. The screw shall be inserted in the lead hole by turning with a screwdriver or other tool, not by driving with a hammer.
 2. The lead hole shall have a diameter of about 70 percent of the root diameter of the screw.
- E. Powder-Actuated Fasteners: When used for the attachment of non-bearing, non-shear wall plates to concrete, the fasteners shall not be installed closer than 3 inches from the edge of the concrete nor shall they be spaced closer than 4 inches. Do not use to install plates to the top of concrete curbs nor where a cold joint is made between the slab and foundation below. Install in accordance with low velocity powder actuated tools in accordance with manufacturer's recommendation

3.06 INSTALLATION OF BUILDING PAPER

- A. Install the specified building paper over all exterior framing members where plywood siding, masonry, or stucco is indicated to be installed, lapping all joints to prevent penetration of water into the stud spaces, and securely fastening the paper in place in accordance with the manufacturer's published recommendations, but in no case less than two inch horizontal laps and six inch vertical laps.

3.07 INSTALLATION OF WOOD DOORS

- A. Prior to installation of each door, carefully inspect the door and verify:
 - 1. That the door furnished is the proper door for the opening, as scheduled and/or specified.
 - 2. That the door is in sound condition, unblemished, without warp, twist, bow or similar conditions.
- B. Trim doors as necessary to provide a uniform clearance between 1/8 inch at jambs and head, and a uniform clearance at the threshold or floor to properly clear the scheduled floor finish.
- C. For each door, verify the hardware type as described in the Door Schedule and verify that the hardware actually supplied is the hardware specified. Using only the specified hinges or butts, and proper equipment for the purpose, install the door into the opening with the following hinge and butt locations throughout the work:
 - 1. Top hinge or butt: The center of the hinge or butt not more than 11" below the top of the door;
 - 2. Bottom hinge or butt: The center of the hinge or butt not more than 13" above the finish floor;
 - 3. Intermediate hinge: Equal distant between the top and butt or pivot: bottom hinge, butt, or pivot.
 - 4. With fine sandpaper, working only in the direction of the grain of the wood, remove all rough edges resulting from door trimming and leave the installed door in a condition to receive finish.

3.08 INSTALLATION OF OTHER FINISH HARDWARE

- A. Locations: Using only the specified hardware, and the proper equipment for the purpose, install all other finish hardware in the following locations throughout the work.
 - 1. Armor plates: On the push side of single-acting doors & on both sides of double-acting doors;
 - 2. Combination push: Centered 40-5/16" above the finish floor.
 - 3. Door pulls on plates: Centered 40-5/16" above the finish floor.
 - 4. Door pulls, sectional: Centered 40-5/16" above the finish floor.
 - 5. Door-closing devices: Install and adjust in strict accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls or corridors shall have the closer mounted on the room side of the door.
 - 6. Extension lever flush: In the edge of the door. Center to bolts: bolt fronts 12" from the bottom and 12" from top edge of the door.
 - 7. Flush cup pulls: Centered 40-5/16" above the finish floor;
 - 8. Key cabinet: Install where directed
 - 9. Kick plates: On single-acting doors: with kick plate on push side. On double- acting doors: with kick plate on both sides.
 - 10. Mortise Deadlock: Center 60" above the finish floor strike.
 - 11. Knob lock and knob: Center 40-5/16" above the finish latch strikes floor.

12. Panic bolt cross bars: Align in horizontal position with top and bottom bolts and rods aligned vertically. Install the centerline of strike 40-5/16" above the finish floor.
 13. Push bars: Centered 42" above the finish floor.
 14. Push plates: Centered 48" above the finish floor.
 15. Other hardware items: Installed as directed.
- B. Anchoring: Anchor all components firmly into position for long life under hard use. Use only the anchoring devices furnished with the hardware item, unless otherwise specifically directed.
- C. Adjustment: Adjust all operating hardware to operate properly in accordance with manufacturer's published recommendations.

3.09 WOOD TRIM

- A. Install wood trim plumb, level and true. Scribe members accurately in place, maintaining full widths of members whenever possible.
- B. Apply trim in full lengths except when single lengths would be impracticable or impossible.
- C. Bevel abutting joints. Miter exterior angles; cope interior angles.
- D. Set all nails for putty.

3.10 CASEWORK

- A. Assemble cabinets and casework in correct locations and position. Securely join each section with concealed fastenings into a continuous unit.
- B. Assemble tops in one length with joints permitted only as shown on drawings. Attach securely to casework.
- C. Scribe casework and tops to abutting surfaces.

3.11 PANELING

- A. Select paneling for uniformity of grain with similar grains adjacent to each other. Install panels symmetrically on and in full widths where conditions permit; otherwise as directed by Architect.
 1. Prefinished Panels: Secure to backing with specified contact adhesive in accordance with procedures recommended by manufacturer.
 2. Job Finished Panels: Secure to supports with finish nails spaced 4 inches on center along the joint, 3/8 inches from edge, and 8 inches on center at intermediate bearings. Countersink nails for putty; sand resulting burr smooth. Bear panels edge on at least 1/3 the width of the support.

3.12 SPECIALTY ITEMS

- A. Install specialty items where the specified item does not include installation within the section in which the item is specified.
- B. Install in accordance with architectural details except when such details are modified by approved shop drawings or installation details. In the absence of such details, install in accordance with manufacturer's recommendations as submitted to and approved by the Architect.

3.13 CLEANING UP

- A. Keep the premises in a neat, safe and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends, and debris.
- B. Do not allow any wood debris in fill or backfill at any area within the site limits.

END OF SECTION

SECTION 06 18 00
GLUED-LAMINATED CONSTRUCTION

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 framing using structural glued-laminated timber.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.

1.3 DEFINITIONS

- A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

1.4 SUBMITTALS

- A. Product Data:
 - 1. For each type of product include data on lumber, adhesives, fabrication, and protection.
 - 2. For preservative-treated wood products include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 3. For connectors include installation instructions.
- B. Shop Drawings:
 - 1. Show layout of structural glued-laminated timber system and full dimensions of each member.
 - 2. Indicate species and laminating combination.
- C. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in ANSI/APA 190.1 and ASTM D3737.
- D. Material Certificates: For preservative-treated wood products from manufacturer. Indicate type of preservative used and net amount of preservative retained.
- E. Research/Evaluation Reports: For structural glued-laminated timber, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: An AITC- or APA-EWS-licensed firm.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 2 PRODUCTS

2.1 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General:
 - 1. Provide structural glued-laminated timber that complies with ANSI A190.1 or research/evaluation reports acceptable to authorities having jurisdiction:
 - a. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.
 - b. Provide structural glued-laminated timber made from single species.
 - c. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
 - d. Provide structural glued-laminated timber made with wet-use adhesive complying with ANSI A190.1.
 - e. Adhesive shall not contain urea-formaldehyde resins.
 - f. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Certified Wood: Glued-laminated timber shall be certified as "FSC Pure" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

2.2 PRESERVATIVE TREATMENT

- A. Preservative Treatment:
 - 1. Where preservative-treated structural glued-laminated timber is indicated, comply with AWWA U1, Use Category 1:
 - a. Use preservative solution without water repellents or substances that might interfere with application of indicated finishes.
 - b. Do not incise structural glued-laminated timber or wood used to produce structural glued-laminated timber.
- B. Preservative (use one of the following):
 - a. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
 - b. Pentachlorophenol in light petroleum solvent.
 - c. Copper naphthenate in a light petroleum solvent.
 - d. Ammoniacal zinc copper arsenate (ACZA) in a water solution.
 - e. Chromated copper arsenate (CCA) in a water solution.
 - f. Ammoniacal copper quat Type A (ACQ-C) in a water solution.
 - g. Propiconazole tebuconazole imidacloprid (PTI) in a water emulsion.
- C. Manufacturer: Simpson Strong Tie or as detailed in the Contract Documents.
- D. After dressing members, apply a copper naphthenate field treatment preservative to comply with AWWA M4 to surfaces cut to a depth of more than 1/16 inch.
- E. Unless otherwise indicated, fabricate from the following materials:
 - 1. Structural-steel shapes, plates, and flat bars complying with ASTM A36.
- F. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness:
 - 1. Primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services')

"Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- G. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123 or ASTM A153.

2.3 MISCELLANEOUS MATERIALS

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.
- C. Sealers shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 FABRICATION

- A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes:
 - 1. Dress exposed surfaces as needed to remove planing and surfacing marks.
- B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber of a 2000-foot radius at roof members and 3500-foot radius at floor members.
- C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWP4 M4:
 - 1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - 2. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- D. End-Cut Sealing: Immediately after end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than ten (10) minutes.
- E. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.

2.5 FACTORY FINISHING

- A. Wiped Stain Finish:
 - 1. Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus:
 - a. Color: As selected by Architect from manufacturer's full range.
- B. Clear Finish: Manufacturer's standard, two-coat, clear varnish finish; resistant to mildew and fungus.

- C. Finishing materials shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates in areas to receive structural glued-laminated timber, with installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place:
 - a. Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- C. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing:
 - 1. Predrill for fasteners using timber connectors as templates.
 - 2. Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 - 3. Coat cross cuts with end sealer.
 - 4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPAC M4:
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- D. Install timber connectors as indicated:
 - 1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
 - 2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

3.3 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

3.4 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades:

1. Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.
2. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

END OF SECTION 06 18 00

SECTION 06 20 00
FINISH CARPENTRY AND MILLWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Providing all finish carpentry items including, but not limited to:
 - a. Finish carpentry.
 - b. Millwork and cabinetry.
 - c. Solid Surface Countertop.
 - d. Plastic laminate.
 - e. Casework hardware.
 - f. Miscellaneous millwork.
 - 2. Installation of:
 - a. Finish hardware.
 - b. Plastic laminate faced wood doors.
- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry.
- C. Reference Standards:
 - 1. Codes and references:
 - a. 2022 California Building Code Section 11B-309.
 - b. American Disabilities Act Design Guidelines (ADADG).
 - 2. American National Standards Institute:
 - a. ANSI A156.9 Cabinet Hardware.
 - b. ANSI A161.1 Woodwork Testing Standards.
 - c. ANSI A208.1 Mat-Formed Wood Particleboard.
 - 3. Woodwork Institute:
 - a. WI North American Architectural Woodwork Standards (current edition).
 - 4. National Electrical Manufacturers Association:
 - a. NEMA LD 3 High Pressure Decorative Laminates.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
 - 2. Manufacturer's preprinted product information for all hardware proposed on the Project.
 - 3. Manufacturer's preprinted maintenance instructions for the casework hardware.
- B. Shop Drawings:
 - 1. Indicate size, material, and finish.
 - 2. Show locations and installation procedures, including hardware, sinks, service fixtures, trim, and other pertinent data for each unit.

- C. Certification: Provide manufacturer's certification that casework has been fabricated and installed according to WI "Custom" Grade guidelines or better.
- D. Samples: Two (2) each, six-inch by six-inch by 3/4-inch (6" x 6" x 3/4") sample of specified particleboard core with grade stamp for use as verification of installed product.
- E. Closeout:
 - 1. Record drawings: Indicate revisions to original Drawings and shop drawings.
 - 2. Manufacturer contact names, addresses, and phone numbers.
 - 3. Finish material schedule: Names and color numbers of laminates and stains.
 - 4. Keys: Provide additional master key for each room and additional locksets totaling one percent (1%) of total Project for attic stock.

1.4 PERFORMANCE REQUIREMENTS

- A. Unless otherwise indicated, perform work in accordance with WI "Architectural Woodwork Standards," Custom Grade, except where specification exceeds those standards the more stringent shall govern.
- B. Fabricate millwork and cabinetry in accordance with ANSI A161.1, NEMA LD3, and general static load testing performed and certified by an independent testing agency covering the following areas of product performance, with these minimum results:
 - 1. Base cabinet construction/racking test: 800 pounds.
 - 2. Cabinet front joint loading test: 425 pounds.
 - 3. Wall cabinet static load test: 2,000 pounds.
 - 4. Drawer front joint loading test: 600 pounds.
 - 5. Drawer construction/static load test: 750pounds.
 - 6. Cabinet adjustable shelf support device/static load test: 300 pounds.
- C. Shelf Loading: Comply with loading/deflection standards of the Composite Panel Association.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.
- B. Installer Qualifications: Licensee of WI's Certified Compliance Program.
- C. Quality Standard:
 - 1. Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements:
 - a. Before delivery to jobsite, millwork supplier:
 - 1) Licensees of WI shall issue a certified compliance certificate indicating millwork products being furnished for this Project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
 - 2) Non-licensees of WI shall provide evidence that they have arranged for inspection by WI inspector after completion of fabrication and installation. If conditions are found to be compliant, inspector will issue Compliance Certificate indicating millwork products being furnished for this Project and certifying that these products and their installation will fully meet requirements of grade or grades specified.

- b. Each elevation of casework and each countertop shall bear certified compliance label.
 - c. Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs.
- D. Certified Seismic Installation Program (CSIP):
 - 1. Before wood or metal stud walls are closed up, provide a written Woodwork Institute CSIP report confirming that acceptable backing is provided in all locations required for casework installation or identifying those locations where backing is missing or improperly located:
 - a. Backing shall consist of a minimum of either three by six (3 x 6) flat Douglas Fir or 16-gage 50 KSI sheet metal.
 - 2. On completion of installation, provide a Woodwork Institute CSIP Certificate identifying the work covered and certifying that installation meets the requirements of the WI CSIP attachment details and schedules.
 - 3. All fees charged by the Woodwork Institute for their CSIP are the responsibility of the millwork installer and shall be included in their bid.
- E. Pre-Installation Conference:
 - 1. See Section 01 31 00: Project Management and Coordination.

1.6 WARRANTY

- A. Warranty the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.
- B. Defects shall include but not be limited to the following:
 - 1. Rough or difficult operation, or loose or missing parts.
 - 2. Delamination of surfaces.
 - 3. Noticeable deterioration of finish.
 - 4. Warped or misaligned surfaces or telegraphing of subsurface imperfections.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed. Store in ventilated place, protected from the weather, with relative humidity range of 20 to 50 percent.
- B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

PART 2 PRODUCTS

2.1 MILLWORK MANUFACTURERS

- A. Woodwork Institute listed Accredited Millwork Companies, current roster and shall not preclude Contractor from using other manufacturers, provided they produce equivalent products of the type specified for the scope and size of the Project. Other manufacturers must have experience manufacturing products meeting or exceeding the specifications and must comply with the criteria performance set by the Woodwork Institute or as indicated in Part 1 of this Section and with Division 01 requirements regarding substitutions.

2.2 MILLWORK MATERIALS

- A. Plastic Laminate:
1. High-pressure decorative laminate complying with NEMA LD3, and the following requirements:
 - a. Exterior color selection available:
 - 1) Architect to select from minimum of 250 selections available, including wood grain patterns and solid colors.
 - 2) Provide five (5) different colors available per project.
 - 3) If laminate has wood grain, direction of grain shall be vertical on door, end panels, fascia panels, and exposed backs; horizontal on drawer faces, aprons, and top rails.
 2. Laminate grades:
 - a. Exposed doors, finished end panels, and other vertical surfaces: GP28 (0.028 inch thick nominal)
 - b. Horizontal surfaces other than top: GP28 (0.028 inch thick nominal)
 - c. Cabinet liner: CL20 (0.020-inch nominal), white.
 - d. Work surfaces and countertops: GP50 (0.050-inch thick nominal) with BK20 (0.20-inch thick) backer sheet.
 - e. Backsplash: PH42 (0.042 inch nominal) with nominally balanced backer sheet.
 3. Adhesive: PVA water resistant adhesive. Contact adhesives not permitted.
 4. Pressure fused laminate:
 - a. NEMA LD3 VGL, and NEMA LD3 CLS, melamine resin impregnated, 120-gram PSM minimum, thermofused to core under pressure.
 - b. Color:
 - 1) Closed interiors, underside of wall cabinets: White.
 - 2) Exposed and semi-exposed open cabinets: Match exterior.
 - c. Provide balanced construction with same thermofused melamine. Unsurfaced coreboard or simple backers not allowed.
- B. Core Material:
1. Particleboard: ANSI 208.1, Grade M-2-Exterior Glue.
 2. Medium-density fiberboard: ANSI A208.2, Grade MD.
 3. Plywood: Shop sanded, exterior grade veneer cored, hardwood faced, any species, with no defects affecting strength or utility. Overlay plywood not permitted. Plywood allowed at countertops and toe-base only.
 4. Water resistant treated plywood shall have 24-hour thickness swell factor of five percent (5%) or less and 24-hour water absorption factor of ten percent (10%) or less; P.S. 51, Type II or better.
 5. Cabinet components shall be of the following minimum core thicknesses:
 - a. Cabinet backs, drawer body, and drawer bottoms: 1/2-inch particleboard.
 - b. Door and drawer face, base, wall, and tall cabinet tops and bottoms, cabinet sides, drawer spreaders, cabinet back rear hangstrips, structural dividers, and exposed cabinet backs: 3/4-inch particleboard.
 - c. Work surfaces and countertops: Minimum one-inch (1") particleboard or plywood, except use water resistant treated plywood core at counters with sinks.
 - d. Shelves: 3/4-inch particleboard core for 30 inches long or less, one-inch (1") thick particleboard core for more than 30 inches long; 14-inch deep, unless otherwise noted. Provide vertical dividers for shelves over 36 inches long.
 - e. Cabinet toe-base: 3/4-inch plywood. No particleboard within four inches (4") of floor.
- C. Countertops - WI Premium Grade: Where indicated on Drawings.
1. Solid Surface:
 - a. Solid surfacing material thickness: 3/4 inch (19 mm).
 - b. Backsplash to match countertops, min 4 inches unless otherwise indicated on Drawings.

- c. Colors, patterns, and finishes: Provide materials and products resulting in colors of solid surfacing material indicated on Drawings.
- 2. Quartz countertops:
 - d. Seams:
 - 1) Fabricate countertops without seams to the extent possible. When seams are necessary, fabricate countertops in sections indicated for joining in field, with sealant filled seams 1/16 inch (1.5 mm) in width.
 - e. Fittings: Drill countertops in shop for fittings and similar items.
 - f. Fabricate with four-inch (4") backsplashes. Sand minor scratches and stains with #400 then #600 sandpaper.
- 3. Fabrication:
 - g. Fabricate tops in one piece, unless otherwise indicated. Comply with solid surfacing material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing:
 - 1) Fabricate tops with shop applied edges of materials and configuration indicated.
 - 2) Fabricate tops with loose backsplashes for field application.
 - h. Drill holes in countertops for plumbing fittings and soap dispensers in shop.
- 4. Countertop construction tolerances:
 - i. Variation from plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1,200 mm).
 - j. Variation from level: Do not exceed 1/8 inch in 96 inches (3 mm in 2,400 mm), 1/4 inch (6 mm) maximum.
 - k. Variation in joint width: Do not vary joint thickness more than 1/4 of nominal joint width.
 - l. Variation in plane at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between planes of adjacent units.
 - m. Variation in line of edge at joints (lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.
- D. Countertops and Backsplashes:
 - 1. Countertops: Where indicated on Drawings; provide countertops with rolled edges in as long as practical continuous lengths. Provide field glued splines at joints. No joints closer than 24 inches either side of sink cutout.
 - 2. Backsplash: Integral to countertop, four inches (4") high unless otherwise shown. Fabricate with single continuous sheet of laminate from front counter to top of splash with no joints from horizontal to vertical application. No joints shall occur at sink openings.
 - 3. At exposed countertop end corners, provide one-inch (1") radius, or similar safety treatment.
- E. Toe Spaces: Leave toe spaces unfinished for installation of resilient base, unless otherwise shown.
- F. End Panels and Filler Strips: Match adjacent case-piece.
- G. Edging:
 - 1. Provide the following in accordance with "Edging Locations:"
 - a. Flat edge PVC: 0.020 inch. Solid, high-impact, purified, color-thru, acid resistant, machine-applied with hot melt adhesives.
 - b. Three-millimeter (3 mm) PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, and machine profiled to 1/8-inch radius.
 - 2. Edging locations:
 - a. Cabinet body edge, including door/drawer front spacer rail: Flat edge PVC, color

- matched to door/drawer face or as selected.
- b. Forward edge of interior body components, interior dividers, shelf, and top edges of drawer body: Flat edge PVC to match cabinet interior surface color.
- c. Door/drawer-front edging: Three-millimeter (3 mm) PVC, color matched to standard laminates.

2.3 CABINET HARDWARE

- A. All hardware shall meet ANSI A156.9 and shall be subject to approval by the Architect. All keying shall match existing master key system and be approved by the Owner:
 - 1. Acceptable manufacturers:
 - a. Knappe & Vogt.
 - b. As specified herein, provide specified product, or Architect approved equal.
- B. Hinges:
 - 1. Heavy duty, five-knuckle 2-3/4-inch institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip, Teflon coated tight pin feature with all edges eased. Hinge shall be full wrap around type of tempered steel 0.095 inch thick. Each hinge shall have minimum of nine (9) screws, #7, 5/8-inch FHMS to assure positive door attachment.
 - 2. One (1) pair per door to 48 inches height. 1-1/2 pair over 48 inches in height. Hinge shall accommodate 13/16 thick laminated door and allow 270-degree swing.
 - 3. Finish: US26D.
- C. Pulls: Wire design, four inches (4"), satin chrome, US26D finish.
- D. Sliding Door Hardware:
 - 1. Frameless 1/4-inch glass sliding doors; double track rolling door assembly.
 - 2. Framed 13/16-inch thick stile and rail sliding doors; top mounted track with dual roller hangers. Vertical adjustment for accurate alignment.
- E. Drawer Slides:
 - 1. Standard drawers: 3/4 extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 100-pound dynamic load rating at full extension.
 - 2. File drawers: Full extension, three-part progressive opening slide, precision steel ball bearing, minimum 100-pound dynamic load rating at full extension, zinc plated or epoxy coated at manufacturer's option.
 - 3. Provide body mounted molded rails for hanging file system for legal or letter size as indicated by manufacturer's model number. Cutting or machining of drawer body/face not permitted.
 - 4. Paper storage drawers: Full extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 150-pound dynamic load rating at full extension.
- F. Catches:
 - 1. Provide opening resistance in compliance with the Americans with Disabilities Act:
 - a. Provide top-mounted magnetic catch for base and wall cabinet door.
 - b. Provide two (2) at each tall cabinet door. Catch housing shall be molded in White.
- G. Adjustable Shelf Supports:
 - 1. Dual-pin design with anti-tip-up shelf restraints for both 3/4-inch and one-inch (1") shelves.
 - 2. Include keel to retard shelf slide-off, and slot for mechanical attachment of shelf to clip.
 - 3. Load rating shall be minimum 300 pounds each support without failure.

- H. Wardrobe Rod: 1-1/6 inch diameter plated steel rod, with captive sockets.
- I. Coat Hooks: Single and double prong, wall mount - satin aluminum.
- J. Locks: Five-disk tumbler cam-style with strike. Locks on cabinets in same room keyed alike. Provide two (2) keys per room where doors and drawers are scheduled to receive locks. Dull chrome finish. Lock core shall be removable with a control key, permitting Owner to change lock arrangements without tools.

2.4 SPECIALTY ITEMS

- A. Grommets:
 - 1. Approved Product/Manufacturer: Model No. EDP3 manufactured by Doug Mockett & Company, Inc. (basis of design), Manhattan Beach, CA; (800) 523-1269, or Architect approved equal.
 - 2. Size: 2-1/2 inches diameter with "Flip-Top"™ tab in cap.
 - 3. Colors: As selected by Architect from manufacturer's available colors.
 - 4. Number/location: Where electrical, telephone, and computer data wiring need to pass through tops whether shown or not.
- B. Keyboard Drawers (at all knee spaces):
 - 1. Approved product/manufacturer: No. SD-1 as manufactured by Knappe & Vogt; or Architect approved equal.
- C. Molded Personal Pencil Drawer: High-impact 100 Polystyrene with in-stop, out-stop, and self-closing features. Provide under top mounted 100-pound self-closing slides. Twelve (12) compartment drawer body, and slides, black. Provide where indicated on plans.
- D. Mailbox Label Holder: Brass, card size 1/2-inch by 2-3/16 inches. Provide one (1) at each opening.

2.5 SOLID STOCK

- A. Moisture Content: Percent of moisture in relation to over-dry weight shall be between eight percent (8%) and 13 percent at time of installation.
- B. Natural Finish Hardwood:
 - 1. Occasional knot permitted provided it is tight and smooth.
 - 2. Grain pattern: Rift-cut.
 - 3. Species: WI "Premium" Grade, white oak.
- C. Paint Grade Hardwood: Any species, including Parana Pine, except do not use oak, elm, or similar species that have coarse grain.

2.6 MISCELLANEOUS

- A. Utility Shelving: WI "Economy" grade.
- B. Clothes Rod: 1-1/2 inch diameter smooth wooden dowel by length required, with end supports and fasteners of type recommended to suit application.
- C. Telephone/MDF/IDF Board: Provide minimum four foot by eight foot by 3/4 inch (4' x 8' x 3/4") thick plywood for telephone/data punch down blocks and video equipment in accordance with Section 06 10 00: Rough Carpentry. Paint in accordance with Section 09

90 00: Painting and Coating.

2.7 MILLWORK FABRICATION

- A. Use the WI Custom Grade woodwork classification unless noted elsewhere complying with referenced quality standard.
- B. Fabricate casework, countertops, and related products to dimensions, profiles, and details shown on Drawings. Fabricate casework square, plumb, and true.
- C. Detailed Requirements for Cabinet Construction:
 - 1. Toe-base:
 - a. Continuous, ladder type platform with concealed fastening to cabinet bottom, level and secured to floor.
 - b. Toe-base at exposed cabinet end panels shall be recessed 1/4 inch from face of finished end for flush installation of finished base material.
 - c. No cabinet sides-to-floor will be allowed.
 - 2. Cabinet top and bottom:
 - a. Solid sub-top shall be furnished for all base and tall cabinets.
 - b. At cabinets over 36 inches, bottoms and tops shall be mechanically joined by a fixed divider.
 - c. Assembly devices shall be concealed on bottom side of wall cabinets.
 - 3. Cabinet sides:
 - a. Doweled, and glued under pressure, or attached with fully concealed interlocking mechanical fasteners to sub-top and bottom.
 - b. Drill holes for adjustable shelves 1-1/4 inch on center.
 - 4. Cabinet backs:
 - a. Side bound, captured in grooves, recessed from cabinet rear, and securely fastened at top and bottom.
 - b. Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of two (2) at base, two (2) at wall, and three (3) at tall cabinets as instructed by casework manufacturer.
 - c. Provide removable back panels and closure panels for plumbing access at all sink cabinets, and where shown on Drawings.
 - 5. Exposed end corner and face frame attachment:
 - a. Butt joint, glued and finish nailed; or attached with fully concealed interlocked mechanical fasteners.
 - 6. Door and drawer fronts:
 - a. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8-inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
 - b. Where indicated, provide stile and rail doors with full 1/4-inch plate glass, hinged or sliding. Exposed lite-opening edges shall be trimmed and glazed with extruded glazing bead.
 - c. Where indicated, frameless sliding glass doors shall be 1/4-inch thick plate glass with ground and polished edges. Fit with anodized aluminum shoes and nylon rollers.
- D. Drawers:
 - 1. Drawer fronts: Apply to separate drawer body component sub-front.
 - 2. Drawer sides: Doweled to receive front and back, glued under pressure, machine squared.
 - 3. Drawer bottom: Set into front and sides, 1/4-inch deep groove with minimum 3/8-inch standing shoulder, continuously glued. Reinforce drawer bottoms with 1/2 inch by four-inch (4") front-to-back intermediate underbody stiffeners, mechanically fastened. One

- (1) at 24 inches, two (2) at 36 inches, and over.
- 4. Paper storage drawers: Fitted with full width hood at back.
- 5. Hanging file drawers shall be fabricated to accept letter size hanging folders compatible with Pendaflex system.
- E. Vertical and Horizontal Dividers: As required by manufacturer for type and style of component.
- F. Door/Drawer Front Rail: As required by manufacturer for type and style of component, and hardware placement.
- G. Accessibility Requirements - 2022 California Building Code, Section 11B:
 - 1. The following special requirements shall be met, where specifically indicated on architectural Plans as "accessible" or by general note. Shall be in compliance with California title 24 access:
 - a. Countertop height: With or without cabinet below, not to exceed a height of 34 inches above finished floor (A.F.F.), at a surface depth of 24 inches.
 - b. Knee space clearance: Minimum 27 inches A.F.F. at apron, and 30 inches clear span width (11B-306.3).
 - c. Sink cabinet clearances: In addition to above, upper knee space frontal depth shall be no less than eight inches (8"), and lower toe frontal depth shall be no less than 11 inches, at a point nine inches (9") A.F.F., and as further described in 11B-306.
- H. Typical Desk or Counter Height at Knee Space Locations: 30 inches A.F.F.

PART 3 EXECUTION

3.1 JOB CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least one (1) week:
 - a. Manufacturer/supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
 - b. After installation, control temperature and humidity to maintain relative humidity between 25 and 55 percent.
- B. Conditions: Do not store or install casework in building until concrete, masonry, and drywall/plaster work is dry.

3.2 COORDINATION

- A. Coordinate the work of this Section with plumbing work specified in Division 22. Coordinate sink opening construction with sinks specified in Division 22 or as indicated on Drawings.
- B. Coordinate location of blocking in walls for installation and support of wall cabinets.

3.3 MILLWORK INSTALLATION

- A. Positioning: Place approximately level, plumb, and at right angles to adjacent work.
- B. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging the products and adjacent work.

- C. Anchorage: Attach securely so the products will perform to their maximum ability without damage from inadequate fastenings.
- D. Fasten tops to frames with concealed clips, screws, and glue.
- E. Install simulated wood trim in locations shown on Drawings and in accordance with manufacturer's instructions.

3.4 EXISTING DOOR LAMINATE RESURFACING

- A. Resurfacing procedures shall be in accordance with the recommendations and instructions of the laminate and adhesive manufacturers.
- B. Acclimate laminate to the same environment as existing material at least 48 hours. Perform work in well-ventilated area, out of the way of construction dust and traffic to maintain clean adhesion.
- C. Clean the substrate with detergent or non-flammable solvent as instructed by laminate manufacturer to remove wax, grease, and polish deposits.
- D. Using a belt sander or sander instructed by manufacturer, sand entire surface to remove original finish. Remove sanding dust thoroughly.
- E. Coat the sanded surface and back of laminate with a uniform coating of contact adhesive. Allow to dry thoroughly prior to assembling. Assembling wet adhesive lines will trap solvent and may result in poor bonding. Follow the adhesive manufacturer's instructions.
- F. Index the laminate with the substrate. Make initial contact by smoothing with palms. Apply pressure using a "J" roller or rotary press. Allow to set as instructed by adhesive manufacturer to achieve full adhesion to maintain warranty. Trim with recommended tools.
- G. Apply laminate to door faces and exposed vertical edges. Apply edges before face. Paint top and bottom edges to color match facing.
- H. Coordinate hardware and vision lite cutouts with work of other Sections.

3.5 FINISH HARDWARE INSTALLATION

- A. The supplier will mark each item of hardware for location. Protect the markings until each item is installed. If any item is delivered to the job not properly marked, return it to the supplier for marking before attempting to install it.
- B. Check markings on hardware for proper location. Install and make necessary adjustments for proper working order. Any hardware damaged by improper adjustment or careless abuse will be replaced by Contractor at his expense.
- C. Provide clean, properly sized, and accurately placed mortises and drilled holes for all mortise hardware such as locksets and for cylindrical locks where specified only.
- D. Fit all surface-applied hardware accurately.
- E. After hardware is installed, protect exposed surfaces by use of heavy paper and masking tape and maintain until job completion.

- F. Remove all finish hardware except that which is primed for painting before painter's finish is applied. Permanently replace and re-adjust for proper function after painter's finish has dried hard.
- G. Millwork contractor shall be responsible for hardware on millwork.

3.6 PLASTIC LAMINATE FACED WOOD DOOR INSTALLATION

- A. Protect all doors during handling.
- B. Install doors in accordance with manufacturer's instructions.
- C. Install and adjust doors for smooth, quiet operation.
- D. Refer to Section 08 81 00 Door Hardware where applicable.

END OF SECTION 06 20 00

SECTION 06 40 00

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide all architectural woodwork shown and/or noted on the drawings, included in the specifications or reasonably there from. Refer to Manual of Millwork, Section 2.
- B. Related Work Described Elsewhere:
 - 1. Section 06 10 00 - Rough Carpentry

1.02 ACTION SUBMITTALS

- A. Product Data: Within 30 days after award of Contract, submit:
 - 1. Sufficient data to demonstrate compliance with specified requirements.
 - 2. Shop Drawings showing each of the items to be provided under this Section, completely detailing joinery and other construction, including anchorage, and with respect to casework, displaying the "Certificate of Compliance" of the Wood Work Institute for the grade specified.
 - 3. Samples of the proposed woods to be used.

1.03 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.
- B. Qualifications of Installers: use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Certification: In addition to complying with all pertinent codes and regulations, comply with the "Manual of Millwork" of the Woodwork Institute of California, latest edition, for the grades specified. Provide certification on Shop Drawings and on each item of casework signifying such compliance.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Refer to Manual of Millwork, Woodwork Institute of California for requirements in addition to those included below.

2.02 LAMINATED PLASTIC CASEWORK

- A. Fabricate in accordance with Section 15 of the Manual of Millwork, except as modified herein:

1. WIC Grade:	Custom and/or Premium at casework with visible interiors.
2. Type:	Type 1.
3. Construction:	Style A-Frameless.
4. Joinery:	Doweled or rabbited.
5. Cabinet Backs:	Required for all casework. (Dadoed Detail 2C and 7C, "Millwork Manual").
6. Cabinet Door Type:	Type "A". Type "B" for glass.
7. Shelves:	Per WIC Section 25A; 3/4-inch minimum; 1 inch thickness for spans 30" or greater. Facings shall be in addition to these thicknesses. (Shelf spans in excess of 4 foot not permitted).
8. Plastic Laminate:	
a. Exposed surfaces (including shelves and interior of open front cabinets):	.028-inch high-pressure plastic laminate, color and pattern selected by District. A maximum of 5 colors and patterns to be selected.
b. Semi-exposed surfaces (behind doors and inside drawers):	Low-pressure decorative polyester or melamine laminates ALA-85.
9. Shelf edge bands:	1mm PVC or PL on front edge. Color to match shelf.
10. Door and Drawer Edge Bands:	3mm PVC radiused 1/8" at edge. Solid color as selected by District.
11. Security Dust Panels:	Plywood, 3/4" thick at all lockable drawers.
12. Base:	4" high with 3" toe kick. At ADA cabinets, use PF Toe Kick by Sunbelt Plastic
a. Finish	Plastic Laminate or Burke Top set per District specifications.

- B. Plastic Laminates approved for use:

1. Nevamar®
2. Wilsonart®
3. Laminart®

C. Chemical resistant laminate:

1. At all cabinets in contact w/ epoxy resin counters only (u.o.n.)
2. Color: See Plans
3. Products approved for use: WA(Chemsurf) or Formica(ChemTop)

2.03 CASEWORK FINISH HARDWARE

A. All casework shall be totally finished in the fabricators shop including the provision and installation of all required hardware. Hardware shall be as scheduled herein, or equal, with exposed surfaces to match the door hardware finishes in the room or area where casework is installed. The following schedule lists a standard of quality for all typical hardware items, some of which may not be required for this project. Shop drawings shall include hardware schedules.

1. Cabinet Hinge: Rockford RP-851 2 3/4 5 knuckle.
2. Cabinet Door Lock: National C-8173-915KA-26D pin tumbler.
3. Cabinet Drawer Lock: National C-8178-915KA-26D pin tumbler.
4. The above locks to be master keyed as directed by the owner.
5. Cabinet Door Latch System:
 - a. Magnetic Catch: KV-916 (KV-918 on wardrobe doors).
 - b. Friction Catch: 2120 FlexaCatch by Bainbridge.
 - c. Slide Bolt: Surface Bolt by Quality Hardware.
6. Drawer Suspension:
 - a. Grass 6610, 100 lb.
 - b. Blum Metabox 3/4 Extension, 75 lb. Dynamic, 100 lb. Static.
7. Door Pulls – Amerock 24017-SN
8. Drawer Pulls – Amerock 24018-SN
9. Shelf Standards:
 - a. KV255 flush mount with KV256R supports.
 - b. Provide earthquake pins in back row.
10. Glass Door Lock:
 - a. KV 965 (opening size under 16 square ft.).
 - b. National C-8140 Pin Tumbler (opening size 16 square ft. or larger).
11. Sliding Glass Door Track:
 - a. KV 1092 (opening size under 16 square ft.).
 - b. KVP-992 roll easy (opening size 16 square ft. or larger).
12. Support (Glass Shelves): KV #256-R or LD-KV348.
13. Sliding Glass Door Pull: KV #831 or Mepla 70.1.
14. Counter Top Hinge--Soss #204.

15. Articulating keyboard shelf slides in and out, raises and lowers 5-3/4" and tilts ± 15 degrees. Keyboard shelf swivels 360 degrees and slides under the desk on a 18" track. Includes fabric covered padded wrist rest.
 - a. Slide-out mouse tray attached to keyboard shelf and slides out to the left or right.

2.04 MOTORS LAMINATED PLASTIC COUNTER TOPS

- A. Fabricate in accordance with Section 16 of the Manual of Millwork:

1. WIC Grade:	Premium.
2. Core Material:	.75-inch minimum. Industrial Grade Particle Board.
3. Plastic Laminate:	.050 inch Formica Color Core, matte finish or equivalent.
4. Adhesives:	Use manufacturer's recommended adhesives. Use clear types where glue lines will be exposed.
5. Backing Sheet:	Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
6. Fastenings:	Fasten countertops with concealed clips, screws, glue blocks or similar hidden fastenings in accordance with the "Architectural Woodwork Institute's Quality Standards for Premium Grade".
7. Standard Cabinet:	
a. Edge Covering:	3mm PVC.
b. Backsplash:	Square Butt (glued and screwed to tops).
c. Top of Backsplash:	Square self-edge.
8. Sink Cabinets:	
a. Core Material:	.075 min. Industrial Grade Particle Board.
b. Backsplash:	Coved.
c. Top of Backsplash:	Square self-edge or 1mm PVC.
d. Edge Covering:	No drip
e. Joints:	No joints permitted through sink openings or other locations where water is used.
f. Sink Opening Sealer:	At sink openings, seal cut edges with a penetrating sealer similar to WoodLife.

9. Plastic Colors and Pattern:	As selected from the manufacture's standard color range, 2 colors minimum, 12 colors maximum.

2.05 SPECIALTY COUNTERTOPS

- A. Stainless Steel Countertops, refer to section 11 40 00 – Foodservice Equipment.

2.06 FABRICATION - CASEWORK:

- A. WIC Casework Grade:

1. Laminated plastic covered modular casework, Deluxe Grade, flush overlay.
2. Laminated plastic tops. Custom Grade.

- B. Types of Casework Units: Various types of units required are typically identified by a WIC model number. Furnish unit with all standard features, plus any modifications shown. Where not identified by model number, furnish unit as detailed and/or constructed similar to standard unit it most closely resembles. Furnish numbers of units shown (see drawings); typically, combinations of equal dimension modules.

- C. Closures: Fabricate cabinets to close tight to abutting construction and other Cabinets, including closing the voids where cabinets on adjacent walls meet in corners.

- D. Locks: Provide where indicated. Mount in specified pulls.

- E. Doors and Hinges: Cabinet construction and door hinges shall permit doors to swing 270° whenever possible.

- F. Holes and Cutouts for Related Work of Other Sections: Verify exact sizes and locations, prior to fabrication.

- G. Coordinate with owner/ architect for grommets locations required for counters and desks. Plan for approximately every 36" for bid purposes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine building surfaces, mechanical and electrical rough-ins, and other related work for proper dimension and alignment.
- B. Do not start work until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Layout locations accurately. Install any stripping or furring required for casework attachment.
- B. Field cut openings as required to accept and/or match related work of other Sections.

3.03 INSTALLATION

A. Casework

- 1. Install by factory trained representatives. Conform to WIC Standards typically, except where shown or specified otherwise.
- 2. General:
 - a. Install plumb and level, without racking or distortion.
 - b. Install continuous cabinet base and anchor to floor.
 - c. Set cabinets on base.
 - d. Shim as necessary with concealed shims.
 - e. Securely anchor in place to base and abutting construction to withstand strain of usage, to conform to OSA requirements, and as indicated.
 - f. Prebore typically for attaching screws and nails, countersink flush typically.
 - g. Scribe fit casework and filler strips to irregularities of walls, ceilings, windows and other abutting work; no scribe moldings.
 - h. Countertops: Scribe fit tops, back splashes, and end splashes to irregularities of walls, windows, and other abutting work. Securely anchor tops to cabinet bodies.
 - i. Adjust operating parts and hardware.
- 3. Sinks:
 - a. Cut out for sinks and faucets. Seal edges of cut-outs with penetrating wood sealer.
 - b. Set sink rim and/or Hudee rim watertight to countertop in sealant or plumbers putty.
 - c. Install loose backs at sink cabinets; cut accurately and fit over plumbing rough-in; and securely screw back in place.
- 4. Keys: Deliver all keys, properly tagged, to District's Inspector for delivery to the District.

B. Wall Shelving

- 1. Screw standards into solid backing. Screw bracket clips to shelving. Install brackets and shelving.

3.04 ADJUSTMENT AND CLEANING:

- A. Adjustment: Adjust operating parts, lubricate as required. Repair damaged surface. Install any missing parts.

- B. Cleaning: Wipe and brush surfaces clean.

END OF SECTION

SECTION 06 83 16
FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Glass fiber reinforced plastic paneling.
 - 2. Trim accessories.
 - 3. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry.
 - 2. Section 07 92 00: Joint Sealants.
 - 3. Section 09 21 16: Gypsum Board Assemblies.

1.3 SUBMITTALS

- A. Product Data: Technical data including supporting documentation of compliance with surface burning characteristics for FRP and accessories.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building code: Comply with applicable requirements of the 2022 CBC for interior plastic materials and interior wall finishes.
 - 2. Surface burning characteristics:
 - a. Determined by testing identical products according to ASTM E84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency:
 - 1) Flame spread index: 25 or less.
 - 2) Smoke developed index: 450 or less.
- B. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Glass Fiber Reinforced Plastic Paneling:
 - 1. Gelcoat finished, glass fiber reinforced plastic panels complying with ASTM D5319:
 - a. Provide USDA accepted panels for incidental food contact.
 - b. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) Marlite (basis of design), 1 Marlite Dr, Dover, OH 4462. Ph: 800-377-1221. www.marlite.com

- 2) Crane Composites, Inc.
- 3) Glasteel.
- 4) Nudo Products, Inc.
- 5) Parkland Plastics, Inc.
- c. Nominal thickness: Not less than 0.09 inch (2.3 mm).
- d. Surface finish: Smooth (no texture).
- e. Color: Selected by Architect.

2.2 ACCESSORIES

- A. Trim Accessories:
 - 1. One-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges:
 - a. Color: Selected by Architect.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, where applicable, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory laminated panels and to be fastened to substrate.
- D. Adhesive: Recommended by plastic paneling manufacturer.
- E. Sealant: Mildew resistant, single component, neutral curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00: Joint Sealants.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

3.2 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels so that trimmed panels at corners are not less than 12 inches (300 mm) wide:
 - 1. Mark plumb lines on substrate at trim accessory panel joint locations for accurate installation.
 - 2. Locate trim accessories panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.4 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned:
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive and nails; no staples. Do not fasten through panels.
- F. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 83 16

SECTION 07 21 10
THERMAL INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Included: Provide building insulation and accessory materials as otherwise required by the Drawings and specified herein.
- B. Related Work in Other Sections:
 - 1. Insulation of mechanical ducts, piping and similar items.
 - 2. Rigid Insulation will be part of the Roofing Specifications.

1.02 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of insulation and with a history of successful production acceptable to the Architect.
- B. Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.03 SUBMITTALS

- A. Product Data: Per the General Conditions – Submittal Procedures:
 - 1. Complete materials list showing all items proposed to be furnished and installed under this Section.
 - 2. Sufficient data to demonstrate that all such materials meet or exceed the specified requirements.

1.04 PRODUCT HANDLING

- A. Delivery and Storage:
 - 1. Deliver all packaged materials to the job site in their original unopened containers with all labels intact and legible at time of inspection.
 - 2. Store all materials in an approved manner, protecting from exposure to the elements.
- B. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.

- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 BUILDING INSULATION

- A. All insulation delivered to the project shall be in original packaging indicating manufacture, insulation type and "R" value. Building insulation shall comply with California Quality Standards for insulating material.
- B. All insulation shall have a flame-spread rating not to exceed 25 and a smoke density not to exceed 450, in accordance with ASTM E84.
- C. Insulation installed where facing is exposed shall be FSK-25 type, having a flame-spread rating not to exceed 25 and a smoke density not to exceed 50, in accordance with ASTM E-84.
- D. All building fiber glass insulation shall be products of Owens/Corning Fiberglass, Manville, CertainTeed, or equal.
- E. Exterior Framed Walls: At new walls provide continuous Type 2 paper backed insulation with a minimum resistance of R-21 at 6" and R-25 at 8" studs. Where called out in drawings, install 1" thick rigid board insulation (R-4 per inch minimum). General contractor to coordinate exact type of rigid insulation board with wall finish manufacturer, to comply with installation/ warranty requirements.
- F. Attic Spaces: All attic spaces shall have continuous insulation of the proper type with a minimum thermal resistance value of R-21 at the walls.
- G. Batt Insulation at all roof decks will be R-38. At areas where underside of roof is exposed to view, a Post Frame Poly-Scrim-Kraft fiber glass blanket insulation is to be provided.
- H. Acoustic Insulation: All interior walls of all Habitable Rooms to be sound walls and shall have stud spaces filled with R-19 Quiet Batt acoustic sound insulation. See floor plans for additional sound walls that may be required. At walls adjacent to ceilings with glue on tiles, run batt insulation to roof deck. All T-Bar Ceilings to have R-11 Quiet Batt acoustic sound insulation laid on top of entire ceiling system.
- I. Insulation Fasteners: Screws and metal plates shall be Johns Manville Ultrafast Screws and Plates and tested and approved by Factory Mutual in accordance with their standard 4470 and listed in the current FM Approval Guide as such.

2.02 ACCESSORIES

- A. All other materials such as wire supports, fasteners and retainers not specifically described but required to complete the work shall be as recommended by approved manufacturer, provided and installed by the Contractor.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this section will be installed. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Except as otherwise specifically directed by Architect, install all building insulation in accordance with approved manufacturer's building insulation application instructions as approved by Architect.

3.03 VERIFICATION

- A. Upon completion of the installation in each case, visually inspect and verify that all insulation is complete and properly installed.

END OF SECTION 07 21 10

SECTION 07 22 00
ROOF AND DECK INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes roof insulation over the properly prepared deck substrate.
- B. Related Sections:
 - 1. Section 07 55 00: Modified Bituminous Membrane Roofing.
 - 2. Section 07 62 00: Sheet Metal Flashing and Trim
- C. Reference Standards:
 - 1. American Society for Testing and materials (ASTM):
 - a. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
 - b. ASTM B29 Standard Specification for Refined Lead.
 - c. ASTM B32 Standard Specification for Solder Metal.
 - d. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
 - e. ASTM C208 Standard Specification for Cellulosic Fiber Insulation Board.
 - f. ASTM C209 Standard Test Method for Cellulosic Fiber Insulating Board.
 - g. ASTM C272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
 - h. ASTM C518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - i. ASTM C578 Standard Specification for Perlite Thermal Insulation Board.
 - j. ASTM C728 Standard Test Methods for Fire Test of Roof Coverings.
 - k. ASTM C1289 Standard Specification for Faced Rigid Polyisocyanurate Thermal Insulation.
 - l. ASTM C1396 Standard Specification for Gypsum Wallboard.
 - m. ASTM D5 Standard Test Method for Penetration of Bituminous Materials.
 - n. ASTM D36 Standard Test Method for Softening Point of Bitumen (Ring and Ball Apparatus).
 - o. ASTM D312 Standard Specification for Asphalt Used in Roofing.
 - p. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
 - q. ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - r. ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - s. ASTM D1863 Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
 - t. ASTM D2126 Standard Test Method for Response of Rigid Cellular Plastics to Thermal Humid Aging.
 - u. ASTM D2178 Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing.
 - v. ASTM D4601 Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
 - w. ASTM D5147 Standard Sampling and Testing Modified Bituminous Sheet Material.

2. Cast Iron Soil Pipe Institute, Washington, D.C. (CISPI).
 - a. Factory Mutual Research (FM): Roof Assembly Classifications.
3. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
4. Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.
5. Warnock Hersey (WH): Fire Hazard Classifications.
6. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
7. Steel Deck Institute, St. Louis, Missouri (SDI).
8. Southern Pine Inspection Bureau, Pensacola, Florida (SPIB).
9. Insulation Board, Polyisocyanurate (FS HH-I-1972).
10. Insulation Board, Thermal (Fiberboard) (FS LLL-1-535B).

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Section 01 33 00: Submittal Procedures.
- B. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.
- C. Provide a sample of each insulation type.
- D. Shop Drawings:
 1. Submit manufacturer's shop drawings indicating complete installation details of tapered insulation system, including identification of each insulation block, sequence of installation, layout, drain locations, roof slopes, thicknesses, crickets, and saddles.
 2. Shop drawing shall include outline of roof, location of drains, a complete board layout of tapered insulation components, thickness, and the average "R" value for the completed insulation system.
- E. Certification:
 1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
 2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

1.4 QUALITY ASSURANCE

- A. Fire Classification, ASTM E108.
- B. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey, or approved third party testing facility in accordance with ASTM E108, Class A for external fire, and meets local or nationally recognized building codes.
- C. Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM [1-90].
- D. Pre-Installation Meeting: Refer to Division 07 (roofing specifications) for pre-installation meeting requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.

- B. Store all insulation materials in a manner to protect them from the wind, sun, and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the Project site.
- C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).
- D. Store materials off the ground. Any warped, broken, or wet insulation boards shall be removed from the site.

PART 2 PRODUCTS

2.1 PRODUCTS, GENERAL

- A. Refer to Section 01 60 00: Product Requirements.
- B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.
- C. Substitutions:
 - 1. Products proposed as equal to the products specified in this Section shall be submitted in accordance with bidding requirements and Division 01 provisions:
 - a. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the State of California. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
 - b. Include a list of three (3) projects of similar type and extent, located within a 100-mile radius from the location of the Project. In addition, the three (3) projects must be at least five (5) years old and be available for inspection by the Architect, Owner, or Owner's representative.
 - c. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
 - d. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 INSULATION MATERIALS

- A. Thermal Insulation Properties and Approved Insulation Boards:
 - 1. Rigid polyisocyanurate roof insulation; ASTM C1289:
 - a. Qualities: Rigid, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
 - b. Thickness: Minimum 5.2 inches.
 - c. R-Value: Minimum 30.
 - d. Compliances: UL, WH, or FM listed under Roofing Systems; Federal Specification HH-I-1972, Class 1.
 - e. Acceptable products:
 - 1) ENRGY-3; Johns Manville.
 - 2) H-Shield; Hunter.
 - 3) EnergyGuard; GAF.
 - 4) Approved equivalent.
 - 2. Tapered polyisocyanurate roof insulation; ASTM C1289:
 - a. Qualities: Factory tapered, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.

- b. Thickness: Minimum as needed for taper crickets for proper slope to drains, tapered design required as part of submittal process.
- c. Average R-Value: Minimum varies.
- d. Tapered Slope: One inch (1").
- e. Compliances: UL, WH, or FM listed under Roofing Systems; Federal Specification HH-I-1972, Class 1.
- f. Acceptable products:
 - 1) ENRGY 3; Johns Manville.
 - 2) EnergyGuard; GAF.
 - 3) H-Shield; Hunter.
 - 4) Approved equivalent.
- 3. High density fiberboard roof insulation; ASTM C208:
 - a. Qualities: Rigid, composed of interlocking fibers factory blended treated with asphalt on the top side.
 - b. Board size: Four feet by eight feet (4' x 8').
 - c. Thickness: Minimum 1/2 inch.
 - d. Compliances: UL, WH, FM listed under Roofing Systems; Federal Specification LLL-I-535-B.
 - e. Acceptable manufacturers:
 - 1) Blue Ridge; Celotex.
 - 2) Temple Inland.
 - 3) Georgia-Pacific.
 - 4) Approved equivalent.
- 4. Dens-deck prime roof board:
 - a. Qualities: Nonstructural glass mat faced, noncombustible, water-resistant treated gypsum core panel.
 - b. Board size: Four feet by eight feet (4'x8').
 - c. Thickness: 1/2 inch.
 - d. R-Value: .56.
 - e. Compliances: UL, WH, or FM listed under Roofing Systems.

2.3 RELATED MATERIALS

- A. Fiber Cant and Tapered Edge Strips:
 - 1. Preformed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer:
 - a. Acceptable manufacturers:
 - 1) The Garland Company, Inc.
 - 2) Celotex.
 - 3) Johns Manville.
 - 4) GAF.
 - 5) Approved Equivalent.
- B. Protection Board: Pre-molded semi-rigid asphalt composition board 1/2 inch.
- C. Roof Board Joint Tape: Six inches (6") wide glass fiber mat with adhesive compatible with insulation board facers.
- D. Asphalt: ASTM D312, Type III Steep Asphalt.
- E. Roof Deck Insulation Adhesive:
 - 1. Insul-Lock E HR - dual-component, high rise foam adhesive with 45 percent rapidly renewable material content as recommended by insulation manufacturer and approved by FM indicated ratings:
 - a. Tensile strength (ASTM D412): 250 psi.
 - b. Density (ASTM D1875): 8.5 lbs./gal.

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- c. Viscosity (ASTM D2556): 22,000 to 60,000 cP.
- d. Peel strength (ASTM D903): 17 lb/in.
- e. Flexibility (ASTM D816): Pass at -70 degrees F.

F. Fasteners:

- 1. Corrosion resistant screw fastener as recommended by roof membrane manufacturer:
 - a. Factory Mutual tested and approved with three inches (3") coated disc for I-90 rating; length required to penetrate metal deck one inch (1").

PART 3 EXECUTION

3.1 EXECUTION, GENERAL

- A. Comply with requirements of Section 01 73 00: Execution.

3.2 INSPECTOR OF SURFACES

- A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation:
- 1. Verify that work that penetrates roof deck has been completed.
 - 2. Verify that wood nailers are properly and securely installed.
 - 3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
 - 4. Do not proceed until defects are corrected.
 - 5. Do not apply insulation until substrate is sufficiently dry.
 - 6. Broom clean substrate immediately prior to application.
 - 7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
 - 8. Verify that temporary roof has been completed.

3.3 INSTALLATION

- A. Base Layer(s) - Attachment with Mechanical Fasteners:
- 1. Approved insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM I-90 system. Otherwise, a minimum of one (1) fastener per two (2) square feet shall be installed.
 - 2. Filler pieces of insulation require at least two (2) fasteners per piece if size of insulation is less than four (4) square feet.
 - 3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches (3"), and a maximum of six inches (6").
 - 4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one inch (1") minimum for metal, wood, and structural concrete decks where not specified by the manufacturer. For gypsum and cement-wood fiber decks, penetration shall be determined from pull-out test results with a minimum penetration of 1-1/2 inches.
 - 5. Gypsum and Cementitious Wood Fiber Decks: Where the roof deck is visible from the building interior, Contractor shall ensure no penetration of fasteners through underside of the deck. Any holes or spalling caused by fastener installation shall be repaired by the roofing contractor. Where the new roof system thickness exceeds an amount so that a minimum of 1-1/2 of penetration cannot be achieved with an Olympic TB Fastener, or approved equivalent, then (and only then) toggle bolts may be used to secure installation to the deck.
 - 6. Tape joints of insulation as per manufacturer's requirements.

- B. Top Layer - Attachment with Insulation Adhesive Approved by FM:
 - 1. Ensure all surfaces are clean, dry, free of dirt, debris, oils, loose or embedded gravel, unadhered coatings, deteriorated membrane, and other contaminants that may inhibit adhesion.
 - 2. Apply insulation adhesive directly to the substrate using a ribbon pattern with 1/4-inch to 1/2-inch wide beads 12 inches o.c., using either the manual applicator or an automatic applicator, at a rate of one (1) gallon per one hundred (150) square feet per cartridge.
 - 3. Immediately place insulation boards into wet adhesive. Do not slide boards into place. Do not allow the adhesive to skin over before installing insulation boards.
 - 4. Briefly step each board into place to ensure contact with the adhesive. Substrates with irregular surfaces may prevent the insulation board from making positive contact with the adhesive. Relief cuts or temporary weights may be required to ensure proper contact.
 - 5. All boards shall be cut and fitted where the roof deck intersects a vertical surface. The boards shall be cut to fit a minimum of 1/4 inch away from the vertical surface.
 - 6. Tape joints of insulation as per manufacturer's requirements.

3.4 CLEANING

- A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

3.5 CONSTRUCTION WASTE MANAGEMENT

- A. Remove and properly dispose of waste products generated during installation. Comply with requirements of authorities having jurisdiction.

END OF SECTION 07 22 00

07 26 00
UNDER-SLAB VAPOR BARRIER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Products supplied under this Section:
 - 1. Vapor barrier for installation under concrete slabs.
 - 2. Accessories.
- B. Related Sections:
 - 1. Section 03 30 00: Cast-in-Place Concrete.
- C. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. 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.
 - b. ASTM E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
 - 2. Technical Reference - American Concrete Institute (ACI):
 - a. ACI 302.1R Guide to Concrete Floor and Slab Construction.
 - b. ACI 302.2R Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

- A. Quality Control/Assurance:
 - 1. Summary of test results per Paragraph 9.3 of ASTM E1745.
 - 2. Manufacturer's samples and literature.
 - 3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
 - 4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

1.4 QUALITY ASSURANCE

- A. Pre-Construction Meeting:
 - 1. Contact vapor barrier manufacturer to coordinate a pre-construction meeting for training on best means and methods and also schedule a review of the vapor barrier installation either by digital review or in person.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Vapor barrier shall have all of the following qualities:
 - 1. Maintain permeance of less than 0.01 Perms (grains/[ft² · hr · inHg]) as tested in

accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).

2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum.
 3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
- B. Vapor Barrier Products:
1. Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com. Basis of design.
 2. Griffolyn VAPORguard by Reef Industries, 713-507-4250. www.reefindustries.com.
 3. PMPC by W.R. Meadows, 800-342-5976. <http://www.wrmeadows.com/pmpc/>.

2.2 ACCESSORIES

- A. Seams:
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- B. Sealing Penetrations of Vapor Barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 3. Perimeter/edge seal: Stego Crete Claw by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 4. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 5. Stego Tack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 6. Use of one-sided seaming tape to seal the perimeter must be submitted to the architect for pre-approval.
- C. Penetration Prevention:
1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- D. Vapor Barrier-Safe Screed System:
1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or geotechnical Engineer:
1. Level and compact base material.

3.2 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643:
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab:
 - a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.
 - b. Overlap joints six inches (6") and seal with manufacturer's seam tape.
 3. Apply seam tape/Crete Claw to a clean and dry vapor barrier.

4. Seal all penetrations (including pipes) per manufacturer's instructions.
5. For interior forming applications, avoid the use of non-permanent stakes driven through the vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier.
6. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
7. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
9. For a vapor barrier-safe, fixed-elevation concrete screeding application, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

END OF SECTION 07 26 00

**SECTION 07 41 13
STANDING SEAM ROOF PANELS**

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. Work described in this section includes pre-formed metal roofing system complete with clips, perimeter and penetration flashing, closures, gutters, and downspouts.
- B. Related work specified elsewhere:
 - 1. Structural steel.
 - 2. Steel joists.
 - 3. Metal roof decks.
 - 4. Wood roof decks.
 - 5. Metal fabrications.
 - 6. Rough carpentry.
 - 7. Flashing and sheet metal. (Not roof panel related).
 - 8. Air barrier and vapor retarder.
 - 9. Thermal insulation.
 - 10. Sealants.

1.3 DEFINITIONS

- A. American Architectural Manufacturer Association (AAMA):
 - 1. AAMA 621-96: Voluntary/Standard Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
- B. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7-05: Minimum Design Loads for Buildings and Other Structures.
- C. American Society for Testing and Materials (ASTM):
 - 1. A653-03: Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. A755-03: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Pre-painted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 3. A792-03: Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

4. B209-02a: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 5. E283-04: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 6. E331-00(2009): Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. Architectural Sheet Metal Manual, 6th edition.
- E. Underwriters Laboratory (UL):
1. UL 580, 4th Ed.: Standard for Tests for Uplift Resistance of Roof Assemblies.
 2. UL 790, 7th Ed.: Standard for Tests for Fire Resistance of Roof Covering Materials.
- F. National Association of Architectural Metal Manufacturers (NAAMM)
1. Metal Finishes Manual for Architectural and Metal Products

1.4 DESIGN AND PERFORMANCE CRITERIA.

- A. Thermal Expansion and Contraction.
1. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling or reducing performance ability.
 2. The design temperature differential shall be not less than 220 degrees Fahrenheit.
 3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.
- B. Wind Uplift Classification:
1. The panel system shall be listed as a Class 90 windstorm rated system, as determined by UL 580.
 2. The panel system shall be ASTM E1592 tested under the supervision of an accredited laboratory and the laboratory shall issue the test report.
 - The testing laboratory shall meet the requirements for compliance with ISO/IEC Standard 17025 or an accredited independent agency recognized by the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement or ANSI
- C. ER Report: The panel system shall be listed on submitted ER or will be cause for rejection.
- D. Fire Resistance Classification: The panel system shall be listed as a Class A Roof Covering, as determined by UL 790.
- E. Air infiltration: The panel system shall be tested in accordance with ASTM E331, and meet or exceed the following performance requirements:

<u>Pressure</u>	<u>Area Leakage Rate</u>
1.57 PSF	0.20 cfm/sq.ft.
6.24 PSF	0.40 cfm/sq.ft.
20.0 PSF	0.60 cfm/sq.ft.

- F. Static air pressure water infiltration: The panel system shall be tested in accordance with ASTM E283, and meet or exceed the following performance requirements:

Pressure	Result
6.2 Gal/Hr per S.F. and Static Air Pressure of 20.0 psf for 15 minutes	No Leakage

1.5 SUBMITTALS.

- A. Shop drawings: Show roof panel system with flashings and accessories in plan view; sections and details. Include metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations. Indicate relationships with adjacent and interfacing work. Shop drawings to be prepared by metal roof panel manufacturer.
- B. Financial Certification: Provide the building owner with a signed and notarized (sealed) affidavit by an officer of the panel system manufacturer which confirms a current minimum corporate asset-to-liability ratio of not less than 3:1 for the panel manufacturer, or its parent corporation. Financial support information and affidavit must be dated within 30 days prior to the product submittal.
- C. Design Test Reports.
1. Submit copies of design test reports for each of the performance testing standards listed in specification article 1.4.
 2. Test reports shall be performed by independent, accredited testing laboratories, and shall bear the seal of a registered professional engineer.
- D. Warranty: Provide unexecuted specimen warranty documents for each warranty as required in specification article 1.10.
- E. Samples.
1. Submit sample of panel section, at least 6" x 6" showing seam profile, and also a sample of color selected.
 2. Submit sample of panel clip, batten seam cap with sealant, and metal closures.

1.6 QUALITY CRITERIA/INSTALLER QUALIFICATIONS.

- A. Engage an experienced metal roofing contractor (erector) to install standing seam system who has a minimum of three (3) years' experience specializing in the installation of structural standing seam metal roof systems.
- B. Contractor must be certified by manufacturer specified as a supplier of standing seam system and obtain written certification from manufacturer that installer is approved for installation of the specified system.
- C. Fabricator/Installer shall submit work experience and evidence of adequate financial responsibility. Architect reserves the right to inspect fabrication facilities in determining qualifications.

1.7 DELIVERY, STORAGE, AND HANDLING.

- A. Inspect materials upon delivery.
- B. Handle materials to prevent damage.
- C. Store materials off ground providing for drainage; under cover providing for air

circulation; and protected from any debris.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.10 WARRANTIES

- A. Manufacturer's Finish Product Warranty:
 - 1. Architectural fluorocarbon finish: Will be free of fading color change in excess of 5 Hunter delta-E units as determined by ASTM D2244-02
 - 2. Will not chalk in excess of numerical rating of 8 when measured accordance with standard procedures specified in ASTM D4214-98 method D659.
 - 3. Will not peel, crack, chip or delaminate.
 - 4. Metal substrate will not rupture, fail structurally, or perforate.
 - 5. A single warranty is required for both substrate and paint. Separate warranties are not acceptable.
 - 6. Warranty shall be 20 years.
- B. Contractor's Warranty
 - 1. Warrant panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship to remain watertight and weatherproof with normal usage for two (2) years following Project Substantial Completion date.
- C. Manufacturer's Watertight Warranty
 - 1. Warranty shall be 20-years.
 - 2. Weathertight warranty shall cover all components of the roofing system including flashings, sealants, fasteners, panels, accessories, and defective materials or workmanship.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

- A. Painted, metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755/A755M.
 - 1. Recycled Content: Manufacturer's standard recycled content..

2. Base Metal: Material conforming to ASTM A792 minimum yield 50,000 psi, thickness 24 gauge.
 3. Protective Coatings: Conform to ASTM A792, AZ50 (Zincalume/Galvalume)
 4. Texture: Smooth surface.
 5. Exposed Coil-Coated Finish:
 - a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Manufacturers' approved applicator to prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Coating system shall provide nominal 1.0 mil (0.025 mm) dry film thickness, consisting of primer and color coat.
 - c. Color shall be selected from Manufacturer's Standard Colors.
 - d. Color: Custom color selected by architect.
 6. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- B. Clear acrylic coated, metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755/A755M.
1. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content is at least 70 percent.
 2. 24-gauge, 55% Aluminum-Zinc alloy coated Steel Sheet, as per ASTM A792: AZ55 (AZ165) coating designation; with a nominal .04 mil (0.010 mm) dry film thickness of a clear organic polymer top film; structural quality, grade 50 ksi (340 MPa).
 3. Texture: Smooth surface.
- C. Panel Sealants:
1. Batten Seam Cap Sealant: Factory applied hot melt, high viscosity, pressure sensitive adhesive with high heat resistance.
 2. Sealant Tape: Non-curing, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1-inch- (13-mm-) wide and 1/16-inch- (3-mm-) thick.
 3. Exposed Sealant: ASTM C 920; elastomeric triopolymer, polyurethane, or other advanced polymer sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
 4. Concealed Sealant: ASTM C 1311: Butyl-Based, Solvent-Release, One-Part Sealant.

2.2 FIELD-INSTALLED THERMAL INSULATION

- A. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 : Glass fiber reinforced facer bonded to a core of polyisocyanurate foam. 20 psi

2.3 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.
 - 1. Type and Thickness: Type X, 5/8 inch (16 mm).
 - 2. The top surface of the substrate board shall be pre-primed to provide for adhesion of the self-adhering underlayment material.
 - 3. Product: Subject to compliance with requirements, provide Dens-Dek Prime by Georgia-Pacific Corporation.
- B. Substrate-Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering with reinforcing scrim, High-Temperature Sheet: 40 mil thick minimum, consisting of slip-resisting top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.
 - 1. Seams shall be lapped in accordance with manufacturer's recommendations.
 - 2. Underlayment shall be approved for 90 days (minimum) of exposure to UV and weather penetrations.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aqua Block 50 by IMETCO.
 - b. Underlayment HT by AEP Span
 - c. WIP 300 by Carlisle

2.5 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C645, cold-formed metallic-coated steel sheet, ASTM A653, G90 (Z275) hot-dip galvanized.
- B. Hat-Shaped, Rigid Furring Channels:
 - 1. Nominal Thickness: As required to meet performance requirements
 - 2. Depth: [As indicated] [7/8 inch (22 mm)] [1-1/2 inches (38 mm)].
 - 3. Top flange: 1-1/8" (28 mm) minimum.
- C. Z-Shaped Furring: With slotted or nonslotted web, flanges of 1-5/8 inches (41 mm) minimum and depth as required to fit insulation thickness indicated.
 - 1. Nominal Thickness: As required to meet performance requirements, but not less than 18 gauge (1.09 mm).
- D. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.6 MISCELLANEOUS MATERIALS

- A. Concealed fasteners: Corrosion resistant steel screws, #10 minimum diameter x

length appropriate for substrate, hex washer head or pancake head. Use self-drilling, self-tapping for metal substrate or A-point for plywood substrate.

- B. Exposed fasteners: 3xx series stainless steel screws (cadmium or zinc coatings are not acceptable) with neoprene sealing washer, or 1/8-inch- (3-mm-) diameter stainless steel rivets.

2.7 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
- B. Narrow-Profile, Snap-on-Batten-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and striations between ribs; designed for independent installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and installation of 1/4-to-3/8-inch- (6-to-10-mm-) wide, snap-on battens over panel joints..
 - 1. Basis-of-Design System: AEP Span Select Seam Narrow Batten Roof System (UES ER 0309), or IMETCO SS roof panel system (UL 580, UL 790).
 - 2. Alternate manufacturers are subject to full compliance with specification requirements, and shall be submitted for approval as follows:
 - a. Manufacturers not listed above must submit for approval, ten (10) days prior to bid date, each of the following: Manufacturer's literature; certification of testing in accordance with specification requirements and article 1.4; sample warranties in accordance with specification article 1.10; installer qualifications in accordance with specification article 1.6, and a list of five (5) similar projects in size and scope of work.
 - 3. Base Metal Material: Steel conforming to ASTM A792 minimum yield 50,000 psi, thickness 24 gauge.
 - 4. Protective Coatings: Conforms to ASTM A792, AZ50 (Zincalume/Galvalume).
 - 5. Characteristics:
 - a. The same panel profile from a single manufacturer shall be used for ALL standing seam roof areas.
 - b. Configuration: Interlocking standing seams with snap-on seam caps incorporating concealed anchor clips allowing thermal movement.
 - c. Narrow Batten Seam Cap: 1/4-inch- (6-mm-) wide x 1-inch- (25-mm-) high seam cap over MINIMUM 3/4-inch- (19-mm-) high panel leg. Seam shall contain factory applied continuous hot gasketing sealant allowing for expansion and contraction of panels due to thermal changes.
 - d. Panel length: Full length without joints.
 - e. Site Formed Panels: Bidder will not be allowed to supply panels formed at the job-site on portable rollformers; metal panels must be factory pre-manufactured and engineered for this project.
 - f. Concealed Standard Anchor Clips: Minimum 24 gauge (0.6 mm) galvanized steel or stainless steel alloy 410 ONE (1) piece clip with provision for unlimited thermal movement in each direction along the longitudinal

STANDING SEAM ROOF PANELS

dimension.

- 1) Two-piece clips are NOT acceptable.
- g. Standing Seam Panel Width: Manufacturer's standard width.
- h. Mechanical Finish: Light striations shall be formed in flat of panel to minimize oil canning and telegraphing of structural members.

2.8 ACCESSORIES

- A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25- mm-) thick, flexible closure strips meeting ASTM D1056 and/or D3575; cut or premolded to match metal roof panel profile. Provide closure strips at rakes, jambs, and where necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from same material and gauge as roof panels, prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.
- C. Gutters: Formed from same material roof panels. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 10-foot- (3-m-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced per SMACNA's recommendation based on gauge and stretch-out, fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match [metal roof panels] [roof fascia and rake trim].
 1. Gutter Hangers: External gutter supports shall be 2-inch- (50-mm-) wide x ¼-inch- (6-mm-) thick formed aluminum, and shall be spaced at no greater than 36" (0.9m) on center. External supports shall be post-painted with a matching full- strength 70 percent PVDF finish and warranted by the panel manufacturer for same term as specified for material finishes.
 2. Gutter Straps: Internal gutter straps shall be 1-inch- (25-mm-) wide x 1/8-inch- (3-mm-) thick formed aluminum, and shall be spaced at no greater than 36" (0.9m) on center. Internal straps shall be post-painted with a matching full- strength 70 percent PVDF finish and warranted by the panel manufacturer for same term as specified for material finishes.
- D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.
 1. Downspout Brackets: Where detailed, surface mounted downspout protection guards shall be fabricated from ¼-inch- (6-mm-) thick formed aluminum, and shall be post-painted with a matching full-strength 70 percent PVDF finish and

warranted by the panel manufacturer for same term as specified for material finishes.

- E. Roof Curbs: Fabricated from same material as roof panels, minimum and welded top box and integral full-length cricket. Fabricate curb subframing of minimum 0.0598- inch- (1.5-mm-) thick, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads, of size and height indicated. Finish roof curbs to match metal roof panels.

2.9 FABRICATION

- A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal roof panel side laps with factory-installed hot melt, high viscosity, pressure sensitive adhesive with high heat resistance, in a manner that will seal weathertight.
- D. Form flashing components from full single width sheet in minimum 10'-0" (3 m) sections. Provide mitered corners, joined using closed end pop rivets and butyl- based, solvent released one-part sealant.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Sealed Joints: Form nonexpanding but movable joints in metal to accommodate butyl-based sealant to comply with SMACNA standards.
 - 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 4. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.10 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - PREPERATION & EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.
- B. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
- C. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
- D. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Substrate Board: Install substrate boards over roof [deck] [sheathing] on entire roof surface. Attach with substrate-board fasteners.
 - 1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 2. Comply with [UL] [FMG] requirements for fire-rated construction.
- C. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.
 - 1. Soffit Framing: [Wire tie] [Clip] furring channels to supports[, as required to comply with requirements for assemblies indicated].
- D. Establish straight, side and crosswise benchmarks
- E. Use proper size and length fastener for strength requirements. Approximately 5/16 inch (8 mm) is allowable for maximum fastener head size beneath the panel.
- F. Rectangular roofs shall be checked for square and straightness. Gable ends may not be straight; set a true line for the gable clips and flashing with string line.
- G. Measure the roof lengthwise to confirm panel lengths, overhangs, coverage of flashings at eaves and ridges and verify clearances for thermal movement.

3.3 THERMAL INSULATION INSTALLATION

- A. Polyethylene Vapor Retarder: Extend vapor retarder to extremities of areas to be

protected from vapor transmission. Repair tears or punctures immediately before concealment by other work.

- B. Board Insulation (reference 2.2.C-G): Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 07 Section "Thermal Insulation."
 - 1. Erect insulation and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches (610 mm) o.c.

3.4 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment:
 - 1. Apply according to manufacturers written instructions.
 - 2. Apply primer if required by manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer.
 - 4. Apply over entire roof surface, wrinkle free, in a shingle fashion to shed water and with ed laps not less than 6 inches staggered at manufacturer's recommended laps between courses. Overlap side edges not less than 3-1/2 inches.
 - 5. Cover underlayment within 90 days.
- B. Felt Underlayment: Apply at locations indicated [below] [on Drawings], in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).
 - 1. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
- C. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.5 STANDING SEAM METAL ROOF PANEL INSTALLATION

- A. All details will be shown on in accordance with approved shop drawings and manufacturer's product data, within specified erection tolerances.
- B. Directly over the completed roof substrate, install one piece clips. [All anchor clips will be set on 16 gauge (1.5 mm) galvanized pre-punched bearing plates to distribute the loads on the board insulation.] All anchor clips will be fastened into the structural roof substrate at 24 inches (0.6 m) o.c. maximum.
- C. Installation of Roof Panels: Roof panels can be installed by starting from one end and working towards the opposite end.
- D. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.
- E. Limit exposed fasteners to extent indicated on contract drawings.
- F. Seal laps and joints in accordance with roofing system manufacturer's product data.
- G. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accordance with standards of SMACNA Manual.
- H. Provide for temperature expansion/contraction movement of panels at roof

penetrations and roof mounted equipment in accordance with system manufacturer's product data and design calculations.

- I. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.
- J. At joints in linear sheet metal items, set sheet metal items in two ¼-inch- (6-mm-) beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.
- K. Remove damaged work and replace with new, undamaged components.
- L. Touch up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish.
- M. Clean exposed surfaces of roofing and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13

**SECTION 07 42 13
METAL PANELS**

1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

- A. This Section includes pre-formed flat seam wall panel system complete with anchor clips, fasteners, flashing, and trim.
- B. Includes all labor, materials, and equipment to install a metal wall panel system over the properly prepared substrate.
- C. Includes a metal wall panel system over self-adhering underlayment and with all accessories as needed for a complete warrantable roofing system.
- D. Related Sections:
 - 1. Section 06 10 00 : Rough Carpentry.
 - 2. Section 07 22 00 : Roof and Deck Insulation.
- E. Reference Standards:
 - 1. American Iron and Steel Institute (AISI):
 - a. Specification for the Design of Cold-Formed Steel Structural Members.
 - 2. American Society for Testing and Materials (ASTM):
 - a. ASTM A240 Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
 - b. ASTM A792 Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - c. ASTM A875 Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process.
 - d. ASTM B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - e. ASTM B370 Specification for Copper and Sheet and Strip for Building Construction.
 - f. ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - g. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.
 - h. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Air Pressure Differences.
 - 3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - a. Architectural Sheet Metal Manual.

1.3. SUBMITTALS

- A. Shop Drawings: Show wall panels (and roofing system, if applicable) with flashings and accessories in elevations, sections, and details. Include metal thickness and finishes, panel lengths, joining details, anchorage details, flashings, and special fabrication provisions for termination and penetrations. Indicate relationships with adjacent and interfacing work.

Indicate fastener types and spacing and provide fastener pullout values. Shop drawings must be completed by the wall panel manufacturer's engineering department. Any and/or all changes recommended by the successful bidder must be approved by the manufacturer in writing prior to submittal.

- B. Product Data: Include manufacturer's detailed material and system description, concealed anchor clips, sealant, and closure installation instructions, and finish specifications. Indicate fastener types and spacing and required fastener pullout values.
- C. Samples:
 - 1. Provide full-size samples of the following materials and system components. Samples shall be of identical material type, thickness, panel width, and material grade/alloy as the system specified for this Project:
 - a. Submit sample of panel section, at least four inches (4") long by full panel width, showing panel profile and a sample of color selected.
 - b. Submit sample of foam closure strips to fit inside and outside specified panel profile.
 - c. Submit sample of panel fasteners.
- D. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the manufacturer and the Owner.
- E. Any material submitted as equal to the specified material must be accompanied by a report signed and sealed by a professional engineer licensed in the State of California. This report shall show that the submitted equal meets the design and performance criteria in this specification. Substitution requests submitted without licensed engineer approval will be rejected for nonconformance.
- F. Design and Test Reports:
 - 1. Provide the following certified test reports from an independent testing laboratory:
 - a. Independent laboratory testing report for system design load and seam integrity.
 - b. A letter from an officer of the manufacturing company certifying that the materials furnished for this Project are the same as represented in tests and supporting data.
 - c. Manufacturer's verifications that the panels are factory roll formed.
 - d. ASTM E283 test results must clearly demonstrate compliance with the performance requirements specified in article 1.9 ASTM E331 Test Report.
 - e. ASTM E330 test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.
 - f. ASTM E331 test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.
- G. Mill production reports certifying that the metal thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.
- H. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7, Method 2 for Components and Cladding. In no case shall the design loads be taken to be less than those detailed in Design and Performance Criteria article.
- I. Qualification Data for Wall System Installer: Refer to Quality Assurance Article below.
- J. Certification of Work Progress Inspection Frequency: Refer to Quality Assurance Article below.
- K. Pre-Installation Conference Proceedings: Refer to Quality Assurance Article below.

- L. Test Reports: Submit third party validation of environmental claims, prepared by UL Environment, for all metal wall panels containing recycled content and/or bio-based content.
- M. Contract Closeout Submittals:
 - 1. General: Comply with requirements of Section 01 77 00: Closeout Procedures.
 - 2. Special Project warranty: Provide specified warranty for the Project, executed by the authorized agent of the manufacturer.
 - 3. Wall panel maintenance instructions: Provide a manual of manufacturer's recommendations for maintenance of installed systems.
 - 4. Insurance certification: Assist Owner in preparation and submittal of wall installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on wall panel system installation and associated work.
 - 5. Demonstration and training schedule: Provide a schedule of proposed dates and times for instruction of Owner's personnel in the maintenance requirements for completed wall panel system installation work.

1.4. PERFORMANCE REQUIREMENTS

- A. Thermal Expansion and Contraction:
 - 1. Completed metal wall panel and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
 - 2. The design temperature differential shall be not less than [200] degrees F.
 - 3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.
- B. Uniform wind load capacity:
 - 1. Installed wall panel system shall withstand negative design wind loading pressures complying with the following criteria. Anchor clips shall be installed exactly as specified.
 - 2. Attach the results of the ASCE 7 minimum design load calculations, as submitted, to this specification. Detailed Drawings showing the specific wind pressure zones shall accompany the calculations:
 - a. Design code: ASCE 7, Method 2 for Components and Cladding.
 - b. Safety factor: 1.67 after any load reduction or material stress increase.
 - c. Category III Building with an Importance Factor of 1.00.
 - d. Wind speed: 115 mph.
 - e. Ultimate pullout value: 434 pounds per each of the two (2) fasteners holding the panel anchor to the wall substrate or framing system.
 - f. Exposure category: B.
 - g. Wall height: Four feet (20').
 - h. Minimum building width: 30 feet.
 - i. Wall area design wind pressure:
 - 1. Zone 4: Field of wall 15.5 psf.
 - 2. Zone 5: Wall corners 19.1 psf.
 - 3. Capacity shall be determined using uniform static air pressure method in accordance with ASTM E330. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above.
- C. ASTM E283 - Static pressure air infiltration (doors, windows, curtain walls):
 - 1. Pressure leakage rate:
 - a. 1.57 PSF 0.0033 cfm/sq. ft.
 - b. 6.24 PSF 0.0056 cfm/sq. ft.
 - c. 12.0 PSF 0.062 cfm/sq. ft.
 - d. 15.0 PSF 0.064 cfm/sq. ft

- e. 20.0 PSF 0.074 cfm/sq. ft.
- D. ASTM E330 - Uniform static load test for structural performance for 1-1/2-inch panel profile:
 - 1. Test results must provide an allowable pressure of no less than:
 - a. 42 lbs/sqft. For three-foot (3'-0") spans.
 - b. 52 lbs/sqft for one-foot (1'-0") span.
- E. ASTM E331 - Static pressure water infiltration (doors, windows, curtain walls):
 - 1. Pressure result:
 - a. 5 Gal./Hr. per S.F. and Static No Leakage.
 - b. Pressure of 20.0 Psf. For 15 minutes.

1.5. QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Engage an installer who has completed the manufacturer's approved contractor course and is currently certified for the installation of the specified system:
 - a. If required, fabricator/installer shall submit work experience and evidence of adequate financial responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.
- B. Source Limitations:
 - 1. Obtain all components of the wall panel system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the manufacturer:
 - a. 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.
 - b. Manufacturer shall have direct authority and control over all fabrication of steel components as well as the raw materials used in their fabrication.
- C. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.
- D. Engage the manufacturer's field representative to conduct required periodic inspections of work in progress as described herein and furnish written documentation of all such inspections.
- E. Manufacturer shall provide the Owner with a written statement that they will provide a site inspection two (2) days per week that confirms that the Project is being constructed as specified, by an experienced, full-time employee of the company.
- F. Alternate Manufacturers:
 - 1. The following manufacturer criteria must be submitted. Alternate systems will not be considered for approval unless each of these items has been submitted for review at least ten (10) business days prior to bid opening:
 - a. Submit each item listed in article 1.3 (A through E) for evaluation of the proposed system.
 - b. Tests shall have been made for identical systems within the ranges of specified performance criteria.
 - c. Empirical calculations for wall performance shall only be acceptable for positive loads.
 - d. A list of a minimum of five (5) jobs where the proposed alternate material was used under similar conditions. The reference list shall include date of project, size of project, project address, and telephone number of architect/owner contact.

- e. A financial statement demonstrating a minimum of a 3:1 ratio of assets to liabilities.
- f. A written statement from the manufacturer stating that they will provide the building owner with a daily site inspection for a minimum of one (1) hour per day by an experienced, full-time employee of the company.
- g. A written statement from the manufacturer stating that they will provide the engineer of record with a daily site inspection by an experienced full-time employee of the company.
- h. A written statement from a corporate officer of the manufacturing company stating that he or she has reviewed the specifications and confirms that the proposed system meets or exceeds all performance requirements listed as well as meets the panel size, gauge, weight, clip design, sealant design, uplift pressures, and height of the vertical seam.
- i. A copy of manufacturer's warranty.
- j. Proof that the manufacturer has been in business for a minimum number of years equal to the warranty period required for this Project.

G. Pre-Installation Conference:

- 1. Convene a pre-installation conference approximately two (2) weeks before scheduled commencement of system installation and associated work.
- 2. Require attendance of installer of each component of associated work that must precede or follow wall panel work (including mechanical or electrical work if any), Architect, Owner, system manufacturer's representative, and other representatives directly concerned with performance of the work, including (where applicable) Owner's insurers, testing agencies, and governing authorities.
- 3. Objectives of conference to include:
 - a. Review foreseeable methods and procedures related to work, including set up and mobilization areas for stored material and work area.
 - b. Tour representative areas of building and inspect and discuss condition of substrates, penetrations, and other preparatory work performed by others.
 - c. Review structural loading limitations of wall framing and inspect for unacceptable variations in planarity.
 - d. Review system requirements (Drawings, specifications, and other Contract Documents).
 - e. Review required submittals both completed and yet to be completed.
 - f. Review and finalize construction schedule related to work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - g. Review required inspection, testing, certifying, and material usage accounting procedures.
 - h. Review weather and forecasted weather conditions and procedures for unfavorable conditions, including possibility of temporary wall protection (if not mandatory requirement).
 - i. Record discussion of conference including decisions and agreements (or disagreements) reached. Furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
 - j. Review notification procedures for weather or non-working days.
 - k. The Owner's representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.
 - l. The intent of the conference is to resolve issues affecting the installation and performance of wall panel work. Do not proceed with work until such issues are resolved the satisfaction of the Owner and Engineer of Record. This shall not be construed as interference with the progress of work on the part of the Owner or Engineer of Record.

H. Manufacturer's Inspections:

1. When the Project is in progress, the wall panel system manufacturer will inspect the work not less than two (2) days per week. In addition, the manufacturer will:
 - a. Keep the Architect or Owner informed as to the progress and quality of the work as observed.
 - b. Provide jobsite inspections a minimum of two (2) days per week.
 - c. Report to the Architect in writing any failure or refusal of Contractor to correct unacceptable practices called to the Contractor's attention.
 - d. Confirm after completion that manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.6. WARRANTY

- A. Manufacturer shall execute a single warranty covering of the following criteria. Multiple-source warranties are not acceptable:
 1. Manufacturer's standard twenty (20) year finish warranty covering checking, crazing, peeling, chalking, fading, or adhesion.
 2. Installer's three (3) year warranty covering wall panel system installation.
 3. Warranties shall commence on date of Substantial Completion.
 4. Provide a single warranty by a single approved manufacturer for roof areas, wall areas, and transitions between the two systems, if applicable.

1.7. DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Responsibilities:
 1. All panels shall be shipped from the manufacturer with a strippable film or similar packaging material separating the individual panels to minimize flexing, stressing, scratching, or otherwise damaging the material during transit to the job.
 2. Fully cover steel with tarpaulins or similar protective cover during transit to prevent dirt and debris from coming in contact with the finished goods.
- B. Installer's Responsibilities:
 1. Stack pre-finished materials to prevent twisting, bending, abrasion, and denting and elevate one end to facilitate moisture run-off.
 2. Unload wall panels using a boom or crane, supporting the panels in at least two (2) locations during lifting, and never lift more than three (3) panels at a time.
 3. Protect moisture-sensitive and water-based materials from the weather.
 4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from Project site.

2.PRODUCTS

2.1. PRODUCTS, GENERAL

- A. Refer to Section 01 60 00: Product Requirements.
- B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.
- C. Substitutions:
 1. Products proposed as equal to the products specified in this Section shall be submitted

in accordance with bidding requirements and Division 01 provisions:

- a. Proposals shall be accompanied by a copy of the manufacturer's standard specification. That specification shall be signed and sealed by a professional engineer licensed in the State of California. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
- b. Include a list of three (3) projects of similar type and extent, located within a 100-mile radius from the location of the Project. In addition, the three (3) projects must be at least five (5) years old and be available for inspection by the Architect, Owner, or Owner's representative.
- c. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
- d. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2. ACCEPTABLE MANUFACTURERS

- A. Basis of Design: AEP Span Flush Panel (UES ER 0309), or IMETCO FW Series Wall and Soffit panel system (ICC ESR-4646).
- B. Site Formed Panels: Bidder will not be allowed to supply panels formed at the jobsite on portable roll formers; metal panels must be factory pre-manufactured and engineered for this Project.

2.3. METAL WALL PANEL SYSTEM

- A. General:
 1. The products, quality, and performance criteria specified shall be regarded as the minimum standard of quality required for the Project.
- B. Materials:
 1. Panel material: 22-gauge, zinc-coated (galvanized) steel sheet, as per ASTM A653: G90 (Z275) coating designation; structural quality, grade 40 ksi (275 MPa).
 2. Flashing and flat stock material: Fabricate in profiles indicated on Drawings of same material, thickness, and finish as wall panel system, unless indicated otherwise.
- C. Finish on Surfaces:
 1. Exposed surfaces for coated panels:
 - a. Two (2) coat coil applied, baked-on full-strength (70 percent resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.
 - b. Color shall be Custom Color
 2. Unexposed surfaces for coated panels shall be baked-on polyester coating with .20 - .30 dry film thickness (TDF).
 3. Exposed and unexposed surfaces for uncoated panels shall be as shipped from the mill.
- D. Characteristics:
 1. Fabrication: Panels shall be factory roll-formed from the specified metal. Field rolled panels will not be allowed.
 2. Configuration: Interlocking lap seam wall panels with ribs at 4" on center, incorporating concealed anchor clips. Through fastened or exposed fastener systems are not acceptable.
 3. Panel seam legs shall be 1-1/2-inch nominal concealed depth behind the panel face. Seam shall allow for expansion and contraction of panels due to thermal changes.
 4. Anchor clips: Clips shall be 22-gauge galvalume steel designed to allow thermal

- movement of the panel in each direction along the longitudinal dimension.
- 5. Panel width (seam spacing): 16-inch nominal.
- 6. Panel lengths: Full length without joints to the extent as is practical.
- 7. Profile of panel face shall have a single vee-groove reveal located three inches (3") in from each panel seam. These will absorb thermal stresses, reduce oil canning, and provide aesthetic appeal.

E. Accessories:

- 1. Fasteners:
 - a. Concealed fasteners: Corrosion resistant steel screws, #10 x 1-inch long, pancake head, Phillips drive. Use self-drilling, self-tapping for metal substrate or A-point for plywood substrate.
 - b. Exposed fasteners: Series 410 stainless steel screws or 1/8-inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the wall panels.
- 2. Provide all miscellaneous accessories for complete installation.

2.4. ACCESSORY PRODUCTS

A. Sealant:

- 1. Acceptable product:
 - a. Concealed application: Non-curing butyl sealant or equal.
 - b. Exposed application: Garland SS sealant or equal.
- 2. Colors: As selected by architect from sealant manufacturer's standard selection.

B. Wall Substrate:

- 1. Install 15/32-inch (minimum) thickness exterior grade plywood sheathing along wall area.

C. Underlayment:

- 1. Underlayment shall be one (1) ply of 60 mil minimum self-adhesive membrane Intelliwrap SA by IMETCO, or Underlayment HT by AEP Span. Seams shall be lapped in accordance with manufacturer's recommendations.

2.5. FABRICATION

- A. Shop fabricate metal panels and flashing components to the maximum extent possible, forming metal work with clear, sharp, straight, and uniform bends and rises. Hem exposed edges of flashings.
- B. Form flashing components from full single width sheet in minimum ten-foot (10') sections. Provide shop fabricated, mitered corners, joined using closed end pop rivets and joint sealant.
- C. Fabricate panels and related sheet metal work in accordance with approved shop drawings and applicable standards.

3.EXECUTION

3.1. PROJECT CONDITIONS

- A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage and protection requirements for wall panel system:
 - 1. Protection:
 - a. Protect completed work from subsequent construction operations. Comply with

manufacturer's recommendations.

- b. Do not encumber the site with stored materials or equipment.
 - c. Do not support wall-mounted equipment directly on the wall panel system.
- B. Ascertain that work of other trades that penetrates the wall or is to be made watertight by the wall is in place and approved prior to installation.

3.2. PREPARATION

- A. Inspection: Examine the alignment and placement of the building structure and substrate. Correct any objectionable warp, waves, or buckles in the substrate before proceeding with installation of the pre-formed metal panels.
- B. Pre-installation conference: Prior to beginning metal wall panel work, convene a pre-installation conference as specified in Part 1 of this Section.
- C. It is understood that the ongoing operations of the Owner area of a critical nature as to leak sensitivity. Do not work on more wall area than can be restored completely watertight in one (1) day.

3.3. INSTALLATION, GENERAL

- A. Install wall system when the atmospheric dry bulb temperature is minimum 40 degrees Fahrenheit and rising.
- B. Install all components of the wall system in exact accordance with the manufacturer's standard published procedures as applicable to these Project conditions and substrates.

3.4. WALL PANEL INSTALLATION

- A. Comply with all details and install wall panel materials and flashings in accordance with approved manufacturer's shop drawings and manufacturer's product data within specified erection tolerances.
- B. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.
- C. Limit exposed fasteners to extent indicated on shop drawings.
- D. Seal laps and joints in accordance with system manufacturer's product data.
- E. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.
- F. Form joints in linear sheet metal to allow for 1/4-inch minimum expansion at 20 feet on center maximum and eight feet (8') from corners.
- G. At joints in linear sheet metal items, set sheet metal items in two (2) 1/4-inch beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

3.5. CLEANING

- A. Clean installed work in accordance with the manufacturer's instructions.
- B. Replace damaged work than cannot be restored by normal cleaning methods.

3.6. CONSTRUCTION WASTE MANAGEMENT

- A. Remove and properly dispose of waste products generated during construction. Comply with requirements of authorities having jurisdiction.

3.7. FINAL INSPECTION

- A. At completion of installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, system manufacturer's representative, and other representatives directly concerned with performance of system.
- B. Inspect work and flashing of penetrations, walls, curbs, and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.
- C. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation that is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- D. Notify the Owner upon completion of corrections.
- E. Following the final inspection, provide written notice of acceptance of the installation from the system manufacturer.
- F. Immediately correct leakage during construction. If the Contractor does not respond within twenty-four (24) hours, the Owner will exercise rights to correct the work under the terms of the conditions of the Contract.

3.8. DEMONSTRATION AND TRAINING

- A. At a time and date agreed to by the Owner, instruct the Owner's facility manager, or other representative designated by the Owner, on the following procedures:
 - 1. Troubleshooting procedures.
 - 2. Notification procedures for reporting leaks or other problems.
 - 3. Maintenance.
 - 4. The Owner's obligations for maintaining the warranty in effect and force.
 - 5. The manufacturer's obligations for maintaining the warranty in effect and force.

END OF SECTION 07 42 13

**SECTION 07 55 00
MODIFIED BITUMINOUS MEMBRANE ROOFING**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Provide labor, materials, services and equipment necessary to furnish and install work as indicated and as specified herein, which includes but is not limited to:
 - 1. Multi-ply modified bitumen roofing system over rigid insulation.
 - 2. System to be cold-applied

1.2 RELATED SECTIONS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim
- B. Section 07 72 33 - Roof Hatches
- C. Section 07 84 00 – Firestopping
- D. Section 07 92 00 – Joint Sealants.

1.3 REFERENCES

- A. 2022 California Building Code (CBC)
- B. American Society of Civil Engineers - Reference Document ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
- C. American National Standards Institute (ANSI):
- D. American Standard of Testing Methods (ASTM):
- E. California Title 24 Energy Efficiency Standards, Cool Roof Rating Council (CRRC) Rated Product Directory.
- F. Factory Mutual (FM):
- G. Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA) Architectural Sheet Metal Manual.
- H. Underwriters Laboratory (UL):

1.4 DEFINITIONS

- A. Roofing Terminology: Definitions in NRCA's The NRCA Roofing and Waterproofing Manual apply to work of this Section
- B. International Institute of Building Enclosure Consultants (IIBEC) Glossary of Building Envelope Terms.

1.5 SUBMITTALS

- A. Assembly Letter: Submit project-specific letter authored by the technical department of the manufacturer of the roofing system addressed to the installer. The letter shall include

the following:

1. Components of the roofing assembly from the deck to the surface of the membrane corresponding to the project specifications.
 2. If the project has multiple assemblies (such as multiple deck types), the letter must include each specified variation.
 3. Attachment of each component of the roofing assembly to its respective substrate. Attachment details shall include:
 - a) Component
 - b) Method of attachment (fastened, self-adhered, etc.)
 - c) Product(s) used (type of fastener, adhesive, etc.)
 - d) Attachment density (fasteners per board, bead spacing, etc.) for the field, perimeter and corner.
 4. Attachment of each component of the base flashing to its respective substrate. Attachment details shall include:
 - a) Component
 - b) Method of attachment (fastened, self-adhered, etc.)
 - c) Product(s) used (type of fastener, adhesive product, etc.)
 5. For each critical layer of the assembly, the required minimum fastener pull-out resistance expressed in pounds-per-square foot to meet specified wind uplift performance requirements for the critical layer(s) of the assembly.
 6. For fire performance, the UL listing number along with the maximum incline for specified fire rating.
 7. For wind performance, a tested assembly corresponding to roofing assembly that meets the wind performance requirements specified. For each assembly specified the tested assembly details shall include:
 - a) Name of the independent third-party testing agency
 - b) Reference number of the assembly.
 - c) Design pressure and/or corresponding uplift resistance achieved.
 8. Contractor eligibility to receive guarantee for project.
 9. Guarantee duration and type
 10. Overburden, if specified, along with details on whether the overburden is included or excluded from the guarantee coverage.
 11. Eligibility of each specified assembly to qualify for any specified guarantee riders such as wind, hail, puncture, etc.
- B. Guarantee Registration: Prior to roofing system installation, installer shall provide a copy of the guarantee application confirmation issued by the roofing system manufacturer. The guarantee registration shall include each roofing section and specified assembly as detailed in the assembly letter. Guarantee registration shall include any specified riders or overburden.
- C. Guarantee: Provide manufacturer's current guarantee specimen for the specified guarantee. If there are any specified riders (such as overburden, hail, etc) a specimen of the rider shall be submitted along with the guarantee specimen.
- D. Certificates: Installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in the section and dated within 30 days of providing submittal.
- E. Cool Roof Rating Council (CRRRC): Submit membrane or coating product listing from the Cool Roof Rated Product Directory listing the minimum 3-year aged solar reflectance, minimum thermal emittance and minimum SRI of submitted membrane.
- F. Product Data Sheets: Submit manufacturer's product data sheets, installation instructions, and/or general requirements for each component.

- G. Detail Drawings: Provide roofing system details and details of attachment to other work, including:
 - 1. Insulation fastening and/or adhesive patterns
 - 2. Base flashings and membrane terminations.
 - 3. For field-fabricated details that do not conform to manufacturer standard details, submit a shop drawing that has been reviewed, approved and stamped by the manufacturer.
 - 4. Tapered insulation shop drawings indicating slopes, crickets, sumps and saddles.
- H. Safety Data Sheets: Provide a table summarizing each product data sheet in the submittal sorted alphabetically by its brand name and cross referencing the corresponding applicable Safety Data Sheet (SDS) with the exact name as it appears on the document. Note which products do not require a SDS in the summary table. Immediately after the summary table document, submit the SDS documents in alphabetical order by their name. Submit the SDS summary table and SDS documents as a separate file if submitting electronically.
- I. Upon substantial completion of work, submit the following to the architect for submission to the owner:
- J. Manufacturer's guarantee: Manufacturer's written guarantee as specified.
- K. Contractor's warranty: Contractor's written warranty as specified.
- L. Maintenance procedures: Three (3) copies of roof system manufacturer's printed instructions for Owner's use regarding care and maintenance of roof.
- M. Letter from roofing manufacturer verifying that guarantee has been paid and is active.
- N. Fastener and/or adhesive pull-out reports
- O. Field quality-control reports from the manufacturer, including all in-progress reports, final inspection and resolution of any punch list items.

1.6 DESIGN / PERFORMANCE REQUIREMENTS

- A. Basis-of-Design: The Garland Company, Inc.; 3800 E. 91st St., Cleveland, OH 44105
- B. Wind Uplift Resistance: Roofing system shall meet the intent of systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressures calculated in accordance with ASCE 7-2016 and having a safety factor of 2 or greater.
- C. Fire Classification:
 - 1. Meets requirements of UL Class A up to 1/2" or greater
- D. Roof Slope:
 - 1. Finished roof slope for membrane surfaces shall be 1/4 inch per foot, two percent (2%) minimum for roof drainage.
- E. Cool Roof Rating Council (CRRC). Membrane or surface coating shall be listed on the CRRC rated product directory with published values meeting or exceeding the following values:
 - 1. Minimum 3-Year Aged Solar Reflectance: 0.63

2. Minimum thermal Emittance: 0.75
3. Minimum Solar Reflectance: 75

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
1. Manufacturer shall be the primary manufacturer of the roofing membrane.
 2. Manufacturer shall supply every component of the roofing assembly included in the guarantee under their brand or have it co-branded.
 3. Manufacturer shall provide a technical representative to inspect the roof with the following qualifications to support this project:
 - a. Not involved in product sales.
 - b. Primarily responsible for evaluating installation of product and training contractors on proper installation techniques.
 - c. Able to attend the pre-construction conference, in-progress meetings and all other site meetings in person.
 - d. Able to provide a minimum of one in-progress visit for each 100 squares of roofing during construction.
 - e. Able to complete the final inspection within 30 days of receiving notice from the installer.
 - f. Able to validate, if necessary, the completion of any punch-list items within 30 days of receiving notice from the installer.
 4. Provide reports to contractor and architect within 5 days of completing the pre-construction conference, in-progress visits, final inspection and any post-final inspections.
 5. Provide specified warranty upon satisfactory project completion.
- B. Contractor Qualifications:
1. Contractor shall be authorized by the manufacturer to install specified materials prior to the bidding period through satisfactory project completion.
 2. Applicators shall have completed projects of similar scope using same materials as specified herein.
 3. Contractor shall provide full time, onsite superintendent or foreman experienced with the specified roof system through satisfactory project completion.
 4. Applicators shall be skilled in the application methods for all materials.
 5. Contractor shall maintain a daily record, onsite, documenting material installation and related Project conditions.
 6. Contractor shall maintain a copy of all submittal documents, onsite, available at all times for reference.
 7. Forward all manufacturer inspection reports to architect within 2 business days of receipt.
- C. Test Reports
1. Roof deck fastener pullout test
 2. Bonded pull test
- D. Source Limitations: All products used in the system and pertaining to the manufacturer's guarantee shall be labeled by the single source roofing manufacturer issuing the guarantee
- E. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.8 WARRANTY

- A. Manufacturer System Warranty
 - 1. Provide manufacturer's no-dollar limit (NDL) guarantee. Manufacturer agrees to repair or replace components in the roofing system which cause a leak due to a failure in materials or workmanship.
 - 2. Single-source guarantee includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, adhesives, cover board, vapor retarder, walkway products, manufacturer's expansion joints, manufacturer's edge metal products, and other approved single source components of roof system marketed by the manufacturer.
 - 3. Duration: Twenty (20) years from the date of Substantial Completion. Guarantees requiring period inspections and certification from the manufacturer are not acceptable.
 - 4. Fees: Contractor is required to include fees associated with manufacturer attendance at the pre-construction conference, one in-progress inspection per 100 squares of roofing during construction, final inspection and any subsequent inspections to resolve punch-list items. For projects with overburden, such as a photovoltaic system, fees associated with the manufacturer reviewing, inspecting and accepting the roofing system as part of the installation of the overburden are included at time of bid.
 - 5. Registration: Contractor is required to list PBK Architects as the architect of record, and BEAM Professionals as the specifier/consultant of record in the appropriate fields when applying for the manufacturer's warranty.
- B. Installer Warranty
 - 1. Provide separate five (5) year workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the installer warranty term defective or otherwise not in accordance with the Contract Documents, the installer shall repair that defect to the Owner and copy be sent to the manufacturer.

1.9 PRE-INSTALLATION CONFERENCE

- A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting in-person at the project site. The installer shall record conference discussions to include decisions and agreements reached (or disagreements), and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.
 - 1. Meet in-person at the job site with the owner's representative, the architect, the consultant, the manufacturer's field technical representative, the deck installer if applicable, and installers whose work interfaces with or affects roofing, including installers of roof accessories, photovoltaic systems, and roof-mounted equipment.
 - 2. At least one of the manufacturer's representatives attending the pre-installation conference must be primarily employed as a field technical representative, not involved with product sales.
 - 3. Installer shall submit a copy of the approved roofing guarantee application prior to the meeting and distribute to the owner's representative and the architect.
 - 4. Review methods and procedures related to roofing installation, including manufacturer's written instructions and the project-specific assembly letter provided in the submittal.
 - 5. Review and finalize construction schedule, and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 6. Define access to the roof and working hours.
 - 7. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

8. Review and finalize construction schedule, and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
9. Review structural loading limitations of roof deck during and after roofing.
10. Review staging areas and loading plan.
11. Review temporary material protecting procedures during storage.
12. Review night seal procedures and requirements.
13. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
14. Review governing regulations and requirements for insurance and certificates if applicable.
15. Review temporary protection requirements for roofing system during and after installation. Discuss requirements of other related trades to immediately mark damaged material and report it.
16. Review roof observation and repair procedures after roofing installation

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Refer to each product data sheet or other published literature for specific requirements.
- B. Delivery of materials in manufacturer's original unopened packaging with all tags and labels intact and legible. Carton and can labels shall indicate appropriate warnings, storage conditions, lot numbers, and usage instructions. Handle and store materials and equipment in such a manner as to avoid damage. The proper storage of materials is the sole responsibility of the unit contractor. Materials damaged in shipping or storage shall not be used. Wet or damaged roofing materials shall be discarded, removed from plant and jobsite, and replaced with new materials prior to application.
- C. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
- D. Protect and store materials in a dry, well-vented, and weatherproof location. Only materials to be used the same day shall be removed from this location. During cold weather, store materials in a heated location, removed only as needed for immediate use.
- E. When materials are to be stored outdoors, store away from standing water, stacked on raised pallets or dunnage, at least four inches (4") or more above ground level. Carefully cover storage with "breathable" tarpaulins to protect materials from precipitation and to prevent exposure to condensation.
- F. Materials shall be stored above 55°F a minimum of 24 hours prior to application.
- G. Ensure that all materials used in the project have a sufficient shelf life to avoid any issues with expiration before the project's completion.
- H. Properly dispose of all product wrappers, pallets, cardboard tubes, scrap, waste, and debris. All damaged materials shall be removed from jobsite and replaced with new, suitable materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of Design Manufacturer: Manufacturer and basis of design shall be the following;

however, products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements specified and acceptance is provided by the Architect in writing prior to bidding

1. The Garland Company, Inc.; 3800 E. 91st St., Cleveland, OH 44105. Local Representative: Richard Jones Phone: (559) 647-1196. rjones@garlandind.com
Web Site: www.garlandco.com.

- B. The following manufacturers are acceptable provided they equal or exceed the specified requirements.

1. GAF
2. Siplast
3. Johns Manville
4. Soprema

2.2 BASE PLY AND CAP SHEET MATERIALS

- A. Roofing Membrane Sheet: SBS-modified asphalt sheet, smooth surfaced, suitable for application method specified.
1. ASTM D6163, Grade S, glass-fiber reinforced.
- B. Roofing Membrane Cap Sheet: SBS-modified asphalt sheet, granular surfaced, suitable for application method specified.
1. ASTM D6163, Grade G, glass-fiber reinforced.

2.3 FLASHING MATERIALS

- A. Backer Sheet: SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.
1. ASTM D6163, Grade S, glass-fiber reinforced.
- B. Flashing Sheet: SBS-modified asphalt sheet, smooth surfaced, suitable for application method specified.
1. ASTM D6164, Grade G, polyester-reinforced
 2. ASTM D6221 or D6162, Grade G, composite polyester and glass-fiber reinforced
- C. Liquid Applied Flashing: A liquid and fabric-reinforced system appropriate suitable for application method specified supplied by the manufacturer of the roofing system and included as part of the roofing system guarantee.

2.4 AUXILIARY ROOFING MATERIALS:

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use.
- B. Cold-Applied Adhesive: Cold-applied adhesive specially formulated for compatibility and use with membrane applications.
- C. Cold-Applied Flashing Adhesive: Cold-applied adhesive specially formulated for compatibility and use with flashing applications.
- D. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for intended use and provided by roofing

manufacturer.

2.5 REFLECTIVE COATING

- A. Base Coating: Coating or primer provided by roofing manufacturer and formulated to prevent bleed through asphalt substrates.
- B. Surface Coating: Acrylic or silicone coating furnished by roofing manufacturer.

2.6 WALKWAYS

- A. 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

2.7 COVER BOARD

- A. Gypsum Board: ASTM C 1177, Heavy duty coated glass-mat facer water-resistant gypsum substrate for adhered roof applications furnished by roofing system manufacturer.
 - 1. Thickness: ½".

2.8 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, glass-reinforced organic facer bonded to a core of polyisocyanurate foam with a compressive strength of 20 psi.
 - 1. Provide insulation package with minimum R-Value of 30
 - 2. Flat and tapered panels to provide slope as required

2.9 INSULATION ACCESSORIES

- A. Provide saddles, crickets, tapered edge strips, and other insulations shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.
- C. Urethane Adhesive: Manufacturer's two component polyurethane adhesive formulated to adhere insulation to substrate.
- D. Insulation Cant Strip:
 - 1. ASTM C 728, perlite insulation board
 - 2. ASTM C 208, cellulosic fiber board.

2.10 EDGE METAL COMPONENTS

- A. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a bifurcation process.
- B. Coping System: Manufacturer's factory fabricated coping consisting of a base piece and a snap-on cap. Provide product from single-source roofing system supplier that is included in the No Dollar Limit guarantee.
- C. Shop-Fabricated Edge Metal: Custom-fabricated edge metal meeting the criterion of

ANSI/SPRI ES-1. Must be approved by manufacturer technical representative.

- D. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Steel Decks:
1. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
 2. Verify that decking is visibly dry and free of moisture.
 3. Verify that the decking is smooth and free of large cracks, holes, or sharp changes in elevation of the surface.
 4. When applicable perform pull test with the specific fastener being used on the project to confirm the fastener resistance meets the requirements for that particular system.
- B. Concrete Decks:
1. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 2. Verify that concrete substrate is visibly dry and free of moisture.

3.2 PREPARATION

- A. General: Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Fill substrate surface voids that are greater than 1/4 inch wide with an acceptable fill material.
- D. Roof surface to receive roofing system shall be smooth, clean, free from loose gravel, dirt and debris, dry and structurally sound.
- E. Prime decks where required, in accordance with requirements and recommendations of the primer and deck manufacturer.
- F. Proceed with each step of installation only after unsatisfactory conditions have been corrected.

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. 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.

3.4 INSULATION INSTALLATION

- A. Coordinate installation of roof system components so insulation and cover board are not

exposed to precipitation or left exposed at the end of the workday.

- B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation boards with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer's written instructions. Fill gaps exceeding 1/4 inch (6 mm) with like material.
- E. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- F. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- H. Installation over Concrete Decks
 - 1. Install each layer in a two-part urethane adhesive according to roofing system manufacturer's instruction.
 - 2. Stagger each layer of insulation
 - 3. Install each layer to resist uplift pressure at corners, perimeter, and field of roof.
- I. Installation over Steel Decks
 - 1. Secure first layer of insulation to deck using mechanical fasteners designed and sized for fastening specified board type to deck type.
 - 2. Install subsequent layers in a two-part urethane adhesive according to roofing system manufacturer's instructions.
 - 3. Install each layer to resist uplift pressure at corners, perimeter and field of roof.

3.5 COVERBOARD INSTALLATION

- A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.
- C. Install cover board with long joints in a continuous straight line. Joints should be staggered between rows, abutting edges and ends per manufacturer's written instructions. Fill gaps exceeding 1/4 inch (6 mm) with cover board.
 - 1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
 - 1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces
- E. Adhered Cover Board: Adhere cover board to substrate as follows:
 - 1. Install in a two-part urethane adhesive according to roofing system manufacturer's instruction
 - 2. Install to resist uplift pressure at corners, perimeter, and field of roof.

3.6 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.
- B. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- C. Where roof slope exceeds 1/2 inch per 12 inches (1:24), contact the membrane manufacturer for installation instructions regarding installation direction and backnailing
- D. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.7 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

- A. Install modified bituminous roofing base sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, with the following installation method:
- B. Unroll roofing membrane sheets and allow them to relax.
- C. Install one lapped base sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.
- D. Adhere modified bituminous roofing membrane base sheet and cap sheet to substrate in cold-applied adhesive according to roofing system manufacturer's instruction.
- E. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - 1. Repair tears and voids in laps and lapped seams not completely sealed.
- F. Install roofing membrane sheets so side and end laps shed water

3.8 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
- B. Prime substrates with asphalt primer if required by roofing system manufacturer.
- C. Backer Sheet Application:
 - 1. Non-Concrete Substrate: Mechanically fasten backer sheet to walls or parapets.
 - 2. Concrete Substrate: Adhere backer sheet to substrate in approved adhesive applied at rate required by roofing system manufacturer
- D. Flashing Sheet Application: Adhere flashing sheet to substrate in approved adhesive applied at rate required by roofing system manufacturer.
- E. Mechanically fasten top of base flashing securely at terminations and perimeter of

roofing.

- F. Roof Drains: Set 30-by-30-inch 4 lb lead flashing sheet in a bed of flashing adhesive on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
- G. Install stripping according to roofing system manufacturer's written instructions.
- H. Flash tubular penetrations using 4lb lead jacks according to manufacturer's written instructions.
- I. Flash all irregular (non-tubular) penetrations using liquid applied flashing system.

3.9 COATING INSTALLATION

- A. A coating is only required if the cap sheet does not meet the aged minimum reflectance performance requirements as specified herein. Cap sheets with a factory-applied coating or specialty granule that meets specified reflective performance requirements do require a coating.
- B. Ensure that all surfaces are clean, dry and free of any dirt, grease, oil or other debris that may interfere with proper adhesion.
- C. Apply base coat or primer to roofing membrane and base flashings as recommended by the manufacturer.
- D. Apply top coat to roofing membrane and base flashings as recommended by the manufacturer. Allow the base coat to completely dry before applying the second coat.

3.10 WALKWAY INSTALLATION

- A. Walkway Pads: Install walkway pads using units of size indicated, or if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

- A. In-Progress Inspections: Arrange for roofing system manufacturer's technical representative to inspect roofing installation and submit report to architect.
 - 1. Minimum one in-progress inspection
 - 2. Additional in-progress inspection for every 100 squares of roofing
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical representative to inspect roofing installation on completion and submit report to Architect.
- C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements

3.12 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. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.13 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.

END OF SECTION 07 55 00

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed steep-slope roof sheet metal fabrications.
5. Formed wall sheet metal fabrications.

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

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

- B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

- C. Samples: For each exposed product and for each color and texture specified.

1.04 INFORMATIONAL SUBMITTALS

- A. Product certificates.

- B. Product test reports.

- C. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.07 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- E. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.

2.03 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Grace Ice and Water Shield HT.
 - c. Owens Corning; WeatherLock Specialty Tile & Metal Underlayment.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.04 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand

design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
 3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 5. Fasteners for Zinc-Coated (Galvanized) Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder:
1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead with maximum lead content of 0.2 percent.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.05 MANUFACTURED REGLETS

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Heckmann Building Products, Inc.
 - c. Hickman, W. P. Company.
 - 2. Material: Aluminum, 0.024 inch thick Galvanized steel, 0.022 inch thick.
 - 3. Finish: Mill.

2.06 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
 - 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.07 ROOF-DRAINAGE SHEET METAL FABRICATIONS: FOR NEW, WHERE INDICATED AND FOR PATCHING EXISTING WHERE REQUIRED

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
 - 1. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.
- B. Built-in Gutters: Fabricate to cross section required, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch-long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
 - 1. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.
 - 2. Fabricate from the Following Materials:
 - a. Galvanized Sheet Metal/Painted: 16 oz./sq. ft..
- C. Downspouts: Fabricate round downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
 - 1. Hanger Style: Manufactures standard.
 - 2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.

2.08 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.
 - 1. Fabricate from the Following Materials:
 - a. Galvanized Steel: 0.028 inch thick.

- B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, solder or weld watertight. Shop fabricate interior and exterior corners.
 - 1. Fabricate from the Following Materials:
 - a. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.
- C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
- D. Counterflashing and Flashing Receivers: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- E. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
- F. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Copper: 12 oz./sq. ft..

2.09 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
- C. Wall Expansion-Joint Cover: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.01 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.02 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 1. Do not solder metallic-coated steel and aluminum sheet.
 2. Do not use torches for soldering.
 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 5. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.03 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
 2. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Built-in Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Slope to downspouts. Provide end closures and seal watertight with sealant.
1. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing. Lap sides minimum of 2 inches over underlying course. Lap ends minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails. Install slip sheet over underlayment.
 2. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.

3.04 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric butyl sealant and clamp flashing to pipes that penetrate roof.

3.05 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.06 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION

**SECTION 07 72 00
ROOF ACCESSORIES**

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Drawings and Conditions of Contract, including General and Supplementary Conditions and Division 1 Administration Sections, apply to this Division.

1.2 INSTALLATION RESPONSIBILITY

- A. In addition to the items normally a part of this Section, coordinate the installation of roof accessory curbs and pipe flashing and equipment supports that may be specified elsewhere.
- B. Coordinate the work specified herein with the following Work:
 - 1. Roofing
 - 2. Roofing sheet metal
 - 3. Mechanical equipment
 - 4. Plumbing
- C. Related Sections:
 - 1. Section 07 55 00: Modified Bitumen Membrane Roofing
 - 2. Section 07 62 00: Roof Related Sheet Metal.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.
- C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.5 WARRANTY

- A. Warranty the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.
- B. Defects shall include, but not be limited to, the following:
 - 1. Noticeable deterioration of finish

2. Leakage of water into the building or within the construction.
- C. Rooftop supports – 5 year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Specifications are based on products of named manufacturers. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 PREFABRICATED ROOF CURBS

- A. Frames:
1. Material: ASTM A 653 G90 hot-dipped galvanized steel.
 - a. Minimum 18 gauge, and as engineered by manufacturer.
 - b. Minimum 18 gauge for curbs supporting HVAC units
 - c. Minimum 20 gauge for expansion joint curbs.
 2. Corners: Mitered and welded (welds are micro sealed and prime painted after fabrication). Bolted connections not accepted.
 3. Base Plates: Integral to frame and welded.
 4. Internally reinforced with galvanized 1 inch by 1 inch by 12 gauge angles for curbs exceeding 3 foot length. Reinforce internal bulkhead at equipment curbs to support lateral loads.
 5. Wood Nailers: Factory installed, pressure treated. Size and width as suitable for support of items installed on curbs.
- B. Insulation: Factory installed 1-1/2 inch thick three-pound density fiberglass insulation.
- C. Curb Height: Minimum 8 inch above finished roof.
- D. Construct curbs to match roof slope with plumb and level top surface for mounting mechanical equipment.
- E. Gasketing: 1/4 inch thick, one (1) inch wide at roof top units.
- F. Counterflashing: 24 gauge stainless steel
- G. Counterflashing Cap: Stainless steel.
- H. Cants:
1. Non-canted curb style installs either under or on top of metal decks with insulation.
 2. Cants shall be provided under Section 07 52 19 - Roofing
- I. All insulated roof curbs shall be structural and shall include calculations signed and sealed by a registered Structural Engineer. Refer to installation drawings for any additional structural requirements. If curbs do not span a minimum of two bar joists, only two angles will be required. Coordination mechanical equipment weight loading on the roof with Structural Engineer.
- J. Approved Manufacturers:
1. Custom Curb, Inc.
 2. Roof Products, Inc.

pipe supports

- K. Gas Pipe Supports:
1. Lines less than 3" OD: (non penetrating)
 - a. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (10 inches x 16 inches x 3 inches; 6 lbs. each); Model Type 10-RAH-8 with strut, roller hanger and hold down clips for lines 2-1/2 inches and smaller
 2. Lines 3" OD or larger: (non penetrating)
 - a. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (18 inches x 16 inches x 3 inches; 10 inches x 16 inches x 3 inches; minimum 6 lbs. each); Model Type Model 8H-CP (Miro) with hanger and roller chair
 3. Approved Manufacture:
 - a. Miro Industries, Inc.
 - b. Portable Pipe Hanger, Inc.
 - c. MAPA Products
 - d. Architectural approved equal
- L. Electrical Conduit / Condensate Lines:
1. Lines less than 3" OD: (non penetrating)
 - a. Provide strut type support with recycled plastics and carbon black for UV protection bases (10 inches x 16 inches x 3 inches; 6 lbs. each), Model Type 16-Base Strut-8
 2. Lines 3" OD or larger: (non penetrating)
 - a. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (18 inches x 16 inches x 3 inches; 10 inches x 16 inches x 3 inches; minimum 6 lbs. each); Model Type Model 8H-CP (Miro) with hanger
 3. Approved Manufacture:
 - a. Miro Industries, Inc.
 - b. Portable Pipe Hanger, Inc.
 - c. MAPA Products
 - d. Architectural approved equal
- M. Chill Water Lines/Freon line sets:
1. Lines less than 3" OD: (non penetrating)
 - a. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (10 inches x 16 inches x 3 inches; 6 lbs. each); Model Type 10-RAH-8 with strut, roller hanger and hold down clips for lines 2-1/2 inches and smaller,
 2. Lines 3" OD or larger: (non penetrating)
 - a. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (18 inches x 16 inches x 3 inches; 10 inches x 16 inches x 3 inches; minimum 6 lbs. each); Model Type Model 8H-CP (Miro) with hanger and roller chair
 3. Approved Manufacture:
 - a. Miro Industries, Inc.
 - b. Portable Pipe Hanger, Inc.
 - c. MAPA Products
 - d. Architectural approved equal

2.3 SEISMIC SUPPORT CURB

- A. Equipment / Gas lines / Electrical Conduit / Condensate Lines / Etc. positive connection to

structure. Unistrut welded to two (2) 10 gauge bent plates equally spaced across 4x6 wood blocking/support curb. Plates set on neoprene isolation pad over galvanized metal cap of flashed into roof system as detailed on drawings and similar to outline of equipment support curb of NRCA guidelines.

2.4 ROOF TO ROOF EXPANSION JOINT

- A. Stainless Steel expansion joint covers on new wood curbs, as detailed on drawings and outlined in NRCA and SMACNA manual.

2.5 RETROFIT ROOF DRAINS

- A. Retrofit Roof Drains: "Hercules RetroDrain" as manufactured by OMG, Inc. or Architect approved equal.
 - 1. Size: To match existing roof drain sizes.
 - 2. Compliance:
 - a. ANSI / SPRI RD-1.
 - b. ULC / ORD-C790.4.
 - 3. Drain Body:
 - a. Material: 1-piece, 11-gauge (0.125-inch) spun aluminum.
 - b. Flange: 17-1/2-inch diameter.
 - 4. Drain Stem Length: 12 inches
 - 5. Flange Includes: Six 2-1/2-inch-long aluminum studs.
 - 6. Sump Area: Depressed.
- B. Strainer Dome:
 - 1. Material: Cast aluminum.
 - 2. Height: 7.25 inches.
 - 3. Outside Base Diameter: 9.77 inches.
- C. Clamping Ring:
 - 1. Material: Cast aluminum.
 - 2. Gravel Stop Height: 1.2 inches.
 - 3. Drainage Slots: 18 V-shaped.
 - 4. Bosses: 6, to accept studs on flange.
- D. Backflow Seal:
 - 1. Compression Seal: Watertight, "U-Flow" mechanical seal.
 - 2. Material: Polyamide and EPDM rubber.
 - 3. Required for Activation: "U-Flow" screwdriver.
- E. Hardware:
 - 1. Locknuts: 6, stainless steel, for studs.
 - 2. Screws: 3, stainless steel, to attach strainer to clamping ring.
- F. Overflows:
 - 1. At overflow locations; provide overflow collar extension
 - 2. Constructed of spun aluminum

PART 3 EXECUTION

3.1 INSTALLATION

- A. Seismic Support Curbs: Install support line for positive connection to structure of each (new and existing) gas line, electrical conduit, condensate line, mechanical ductwork, freon line

sets, etc running across new roof system.

1. Spacing: Shall not exceed twenty (20) feet on center. Curb not to exceed twelve (12) inches from any change in direction or elevation. Along with any additional locations indicated on drawings.
 2. Piping containing liquid to be supported on roller accessories similar to specified for gasoline pipe support. Install hold down clips or guides to ensure piping to stay in contact with roller support or Unistrut.
- B. Non-Penetrating pipe supports: Install roof accessory in accordance with manufacturer's printed instructions and approved shop drawings.
1. Spacing not to exceed six (6) feet on center between seismic support curbs. With in twelve (12) inches from any change in direction or elevation not support by seismic curb.
 2. Provide roof manufacture protection pad below each support, tacked in place with approved mastic or adhesive.
 3. Install hold down clips or guides to ensure piping to stay in contact with roller support or Unistrut.

3.2 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 07 72 00

**SECTION 07 72 33
ROOF HATCHES**

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. Work Includes:
 - 1. Provide factory-fabricated roof hatches for ladder access.
 - 2. Provide factory-fabricated fixed hatch railing system.
 - 3. Provide factory-fabricated ladder safety posts.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 07 62 00: Sheet Metal Flashing and Trim.
 - 4. Section 07 72 00: Roof Accessories.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
- B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
- C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer: A minimum of five (5) years' experience manufacturing similar products.
- B. Installer: A minimum of two (2) years' experience installing similar products.
- C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.5 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five (5) years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer:
 - 1. The BILCO Company, New Haven, CT.
 - 2. Milcor, Grand Rapids, MI.
 - 3. Approved equal.

2.2 ROOF HATCH

- A. Basis of Design: Bilco Type S-50.
- B. Furnish and install where indicated on plans metal roof hatch Type S, size width: 36 inches (914mm) by length: 30 inches (762mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.
- C. Performance Characteristics:
 - 1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span and a 140 psf (684 kg/m²) wind uplift for aluminum (Type S-50) roof hatches.
 - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - 3. Operation of the cover shall not be affected by temperature.
 - 4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
- D. Cover: Shall be 11-gauge (2.3mm) aluminum with a three-inch (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
- E. Cover Insulation: Shall be fiberglass of one-inch (25mm) thickness, fully covered and protected by a metal liner 18-gauge (1mm) aluminum.
- F. Curb: Shall be 12 inches (305mm) in height and of 11-gauge (2.3mm) aluminum. The curb shall be formed with a 3-1/2-inch (89mm) flange with 7/16-inch (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, six inches (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.
- G. Curb Insulation: Shall be rigid, high-density fiberboard of one-inch (25mm) thickness on outside of curb.
- H. Lifting Mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe for aluminum construction, welded to the curb assembly.
- I. Hardware:
 - 1. Heavy pintle hinges shall be provided.
 - 2. Cover shall be equipped with a spring latch with interior and exterior turn handles.
 - 3. Roof hatch shall be equipped with interior and exterior padlock hasps.

4. The latch strike shall be a stamped component bolted to the curb assembly.
 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a one-inch (25mm) diameter red vinyl grip handle to permit easy release for closing.
 6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- J. Finishes: Factory finish shall be mill finish aluminum.
- K. Accessories:
1. At each roof hatch provide the following:
 - a. Hatch Rail System.
 - b. Ladder Safety Post.

2.3 HATCH RAIL SYSTEM

- A. Furnish and install where indicated on plans hatch rail system Model RL2-S. The hatch rail system shall be field assembled and installed per the manufacturer's instructions.
- B. Performance Characteristics:
1. High visibility safety yellow powder coat paint finish.
 2. Hatch rail system shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
 3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two (2).
 4. Corrosion resistant construction with a five (5) year warranty.
 5. Hinged gate shall ensure continuous barrier around the roof hatch.
 6. Self-closing gate hinge and positive latching system provided with hatch rail system.
- C. Posts and Rails: 1-1/4-inch (32mm) 6061 T6 schedule 40 aluminum pipe.
- D. Hardware: Mounting brackets shall be 3/8-inch (9mm) thick extruded aluminum. Pivoting post guides with compression fittings and latching mechanism shall be cast aluminum. Self-closing hinges and all fasteners shall be type 316 stainless steel.

2.4 LADDER SAFETY POST

- A. Furnish and install where indicated on plans ladder safety post Model LU-1. The ladder safety post shall be pre-assembled from the manufacturer.
- B. Performance Characteristics:
1. Tubular post shall lock automatically when fully extended.
 2. Safety post shall have controlled upward and downward movement.
 3. Release lever shall disengage the post to allow it to be returned to its lowered position.
 4. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14 inches (356mm) on center and clamp brackets to accommodate ladder rungs up to 1-3/4 inch (44mm) in diameter.
- C. Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.
- D. Material of Construction: Steel.

- E. Balancing Spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.
- F. Hardware: All mounting hardware shall be Type 316 stainless steel.
- G. Finishes: Factory finish shall be yellow powder coat steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work:
 - 1. Test units for proper function and adjust until proper operation is achieved.
 - 2. Repair finishes damaged during installation.
 - 3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer that will not damage finish.

END OF SECTION 07 72 33

SECTION 07 81 23 INTUMESCENT FIREPROOFING

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 requirements including but not limited to:
 - 1. Mastic and intumescent fire resistive coatings.
 - 2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings - Framing plans or schedules, or both, indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of fireproofing after application.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.
- D. Qualification Data: For installer and testing agency.
- E. Product Certificates: For each type of fireproofing.
- F. Evaluation Reports: For fireproofing, from ICC-ES.

1.4 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire resistance design and manufacturer's written instructions.
- B. Fire Resistance Design:
 - 1. Indicated on Drawings, tested according to ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
 - a. Steel members are to be considered unrestrained unless specifically noted otherwise.
- C. Surface Burning Characteristics - Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
 - 1. Flame spread index: 25 or less.
 - 2. Smoke developed index: 450 or less.

- D. Asbestos: Provide products containing no detectable asbestos.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Mockups:
1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution:
 - a. Build mockup of each type of fireproofing and different substrate and each required finish.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - c. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Pre-Installation Conference:
1. Conduct conference at Project site:
 - a. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.
 - b. Review all metal materials, remove all corrosive materials, and provide primers and/or substrate material required by manufacturer.

PART 2 PRODUCTS

2.1 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Mastic and Intumescent Fire Resistive Coating, Interior Use:
1. Factory mixed formulation consisting of intumescent base coat and topcoat (if required), and complying with indicated fire resistance design:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) Isolatek International, CAFCO SprayFilm WB 4 (basis of design).
 - 2) Albi Manufacturing; a division of StanChem, Inc.
 - 3) Carboline Company; a subsidiary of RPM International.
 - b. Interior application: Designated for interior general purpose, conditioned interior space purpose use by a qualified testing agency acceptable to authorities having jurisdiction.
 - c. Thickness: Required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
 - d. Hardness: Not less than 65 Type D durometer, according to ASTM D2240.
 - e. Finish is as selected by Architect from manufacturer's standard finishes or spray-textured finish:
 - 1) Color and gloss: As indicated by manufacturer's designations, match Architect's sample or as selected by Architect from manufacturer's full range.
- B. Mastic and Intumescent Fire Resistive Coating, Exterior Use:
1. Factory mixed formulation consisting of intumescent base coat and topcoat (if required) and complying with indicated fire resistance design:

- a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) Isolatek International, CAFCO SprayFilm WB 4 System (basis of design).
 - 2) Albi Manufacturing; a division of StanChem, Inc.
 - 3) Carbolite Company; a subsidiary of RPM International.
- b. Exterior application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
- c. Thickness: Required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
- d. Hardness: Not less than 65 Type D durometer, according to ASTM D2240.
- e. Finish is as selected by Architect from manufacturer's standard finishes or spray-textured finish:
 - 1) Color and gloss: As indicated by manufacturer's designations, match Architect's sample or as selected by Architect from manufacturer's full range.

2.2 AUXILIARY MATERIALS

- A. Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Reinforcing Fabric: Glass or carbon fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 degrees F (10 degrees C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design:
 - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds,

mill scale, loose scale, incompatible primers, paints, and encapsulate, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.

2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items are securely attached to substrates.
 3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- C. Prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.4 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing:
1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended

in writing by fireproofing manufacturer.

- E. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- F. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- I. Cure fireproofing according to fireproofing manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes - Where indicated, apply fireproofing to produce the following finish:
 - 1. Manufacturer's standard finishes: Finish according to manufacturer's written instructions for each finish selected.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections for tests and inspections as required by the CBC and DSA classified projects.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections:
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.6 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to Work of other trades.

- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 23

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
1. Penetration firestop systems.
 2. Fire resistive joint systems.
 3. Repair of firestop assemblies disturbed by the work.
 4. Smoke barriers.
 5. Accessories necessary for a complete installation.
- B. Related Sections:
1. Section 07 81 00: Applied Fireproofing.
 2. Section 07 81 23: Intumescent Fireproofing.
 3. Section 07 92 00: Joints Sealants.
 4. Division 23: Heating, Ventilating & Air Conditioning (HVAC).
 5. Division 26: Electrical.
- C. Reference Standards:
1. Part 1 2022 California Administrative Code, Title 24 C.C.R.
 2. Part 2 2022 California Building Code, Title 24 C.C.R.
 3. Part 3 2022 California Electrical Code, Title 24 C.C.R.
 4. Part 4 2022 California Mechanical Code, Title 24 C.C.R.
 5. Part 5 2022 California Plumbing Code, Title 24 C.C.R.
 6. Part 6 2022 California Energy Code, Title 24 C.C.R.
 7. Part 8 2022 California Historical Code, Title 24 C.C.R.
 8. Part 9 2022 California Fire Code, Title 24 C.C.R.
 9. Part 10 2022 California Existing Building Code, Title 24 C.C.R.
 10. Part 11 2022 California Green Building Standards Code (CALGreen Code), Title 24 C.C.R.
 11. Part 12 2022 California Referenced Standards Code, Title 24 C.C.R.
 12. NFPA 13 Automatic Sprinkler Systems (California Amended), Current Edition.
 13. NFPA 14 Standpipe Systems (California Amended), Current Edition.
 14. NFPA 17 Dry Chemical Extinguishing Systems, Current Edition
 15. NFPA 20 Stationary Pumps, Current Edition.
 16. NFPA 24 Private Fire Service Mains (California Amended), Current Edition.
 17. NFPA 72 National Fire Alarm and Signaling Code (California Amended) Current Edition (Note: See UL Standard 1971 for Visual Devices).
 18. NFPA 80 Fire Door and Other Opening Protectives, Current Edition.
 19. NFPA 253 Critical Radiant Flux of Flooring Covering Systems, Current Edition.
 20. NFPA 2001 Clean Agent Fire Extinguishing Systems (California Amended), Current Edition.
 21. Americans with Disabilities Act (ADA), Title II.
 22. Fire Test Response Characteristics:
 - a. Provide firestop systems complying with requirements:
 - 1) Penetration firestop systems are identical to those tested in accordance with

- UL. Provide rated systems complying with requirements:
 - a) Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - b) Penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - c) Penetration firestop systems correspond to those indicated by reference to penetration firestop system designations listed by UL in its Fire Resistance Directory and FM Global in its Building Materials Approval Guide.
- b. Fire Resistive Joints:
 - 1) Perform fire resistance tests by UL with follow up inspection services for fire resistive joint systems acceptable to authorities having jurisdiction:
 - a) Fire resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b) Fire resistive joint systems correspond to those indicated by reference to penetration firestop system designations listed by UL in its Fire Resistance Directory.

1.3 SUBMITTALS

- A. Product Data: Technical data including installation recommendations, construction conditions, and applicable UL assemblies.
- B. Shop Drawings:
 - 1. For each penetration firestop or fire resistive joint system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetration. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated:
 - a. Submit documentation, including illustrations, from qualified testing and inspecting agency, applicable to each firestop system configuration for construction and penetrating items.
- C. Product Certificates: For penetration firestop system products, signed by product manufacturer.
- D. Product Test Reports: From a qualified testing agency indicating penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.4 PERFORMANCE REQUIREMENTS

- A. Penetration Fire Resistance Systems:
 - 1. For penetrations through vertical and horizontal fire resistance rated constructions, including both empty openings and openings containing penetrating items, provide firestop systems produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and gases, and maintain original fire resistance rating of construction penetrated.
 - 2. Rated systems:
 - a. Provide penetration firestop systems with ratings determined in accordance with UL 1479 for C-AJ, C-BJ, C-BK, F-A, F-B, F-C, W-J, W-K, and W-L classified systems:
 - 1) F rated systems: Provide penetration firestop systems with F ratings indicated, but not less than that equaling or exceeding fire resistance rating of constructions penetrated.
 - 2) T rated systems: For specified conditions, provide penetration firestop systems with T ratings indicated, as well as F ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in

- occupiable floor areas.
 - 3) L rated systems: Where penetration firestop systems are indicated in smoke barriers, provide penetration firestop systems with L ratings of not more than 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 degrees F (204 degrees C).
 - 4) For penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to conditions both during and after construction.
 - 5) For piping penetrations for plumbing and wet pipe sprinkler systems, provide moisture resistant penetration firestop systems.
 - 6) For penetrations involving insulated piping, provide penetration firestop systems not requiring removal of insulation.
 - 3. For penetration firestop systems exposed to view, provide products with flame spread and smoke developed indexes of less than 25 and 450, respectively, determined in accordance with ASTM E84.
- B. Fire Resistive Joint Systems:
- 1. System produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and gases, and maintain original fire resistance rating of assembly in which fire resistive joint systems are installed:
 - a. Joint systems in and between fire resistance rated constructions: Provide systems with assembly ratings equaling or exceeding fire resistance ratings of construction that are joined, with movement capabilities and L ratings indicated determined by UL 2079.
 - b. Perimeter fire resistive joint systems: For joints between edges of fire resistance rated floor assemblies and exterior curtain walls, provide systems of type and with ratings indicated, determined by NFPA 285 and UL 2079.
 - c. For fire resistive systems exposed to view, provide products with flame spread and smoke developed indexes of less than 25 and 450, respectively, determined in accordance with ASTM E84.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
- 1. A firm experienced in installing firestop systems and who has been approved by FM Global according to FM Global 4991 Approval of Firestop Contractors or been evaluated by UL and found to comply with UL Qualified Firestop Contractor Program Requirements and has minimum five (5) years' documented experience in installing firestopping assemblies:
 - a. Manufacturer's willingness to sell its penetration firestop system products to Contractor or to installer engaged by Contractor does not qualify buyer/installer.
- B. Installation Responsibility: Assign installation of penetration firestop systems and fire resistive joint systems to a single qualified installer.
- C. Source Limitations: Obtain firestop systems for each kind of penetration and construction condition indicated; one (1) source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestop system products to site in original, unopened containers or packages with intact and legible manufacturer labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for penetration firestop systems to prevent their deterioration or

damage due to moisture, temperature changes, contaminants, or other causes.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturer:
 - 1. Subject to compliance with requirements, provide firestop systems by one of the following for each application required:
 - a. Specified Technologies Inc
 - b. Hilti, Inc.
 - c. 3M; Fire Protection Products Division.
 - d. USG Corporation.
 - e. Tremco Commercial Sealants and Waterproofing.
- B. Compatibility: Provide firestop systems compatible with each other; with substrates forming openings; and with items penetrating penetration firestop systems, under conditions of service and application, demonstrated by penetration firestop system manufacturer based on testing and field experience.
- C. Accessories:
 - 1. Provide components for each firestop system necessary to install fill materials. Use components specified by penetration firestop or fire resistive joint system manufacturer and UL. Accessories include, but are not limited to:
 - a. Penetration firestop systems: Provide penetration firestopping produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and gases, and maintain original fire resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with substrates forming openings, and with penetrating items if any.
 - b. Accessories - Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated:
 - 1) Permanent forming/damming/backing materials, including the following:
 - a) Slag wool fiber or rock wool fiber insulation.
 - b) Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c) Fire rated form board.
 - d) Fillers for sealants.
 - 2) Temporary forming materials.
 - 3) Substrate primers.
 - 4) Collars.
 - 5) Steel sleeves.
- D. Fill Materials:
 - 1. Penetration firestop systems containing types of fill materials indicated. Fill materials are those referenced in directories of referenced testing and inspecting agencies as fill, void, or cavity materials:
 - a. Cast in place firestop devices: Factory assembled devices for use in cast in place concrete floors and consisting of an outer metallic sleeve lined with intumescent strip, radial extended flange attached to one end of sleeve for fastening to concrete formwork, and neoprene gasket.
 - b. Latex sealants: Single component latex formulations that after cure do not reemulsify during exposure to moisture.
 - c. Firestop devices: Factory assembled collars formed from galvanized steel and

- lined with intumescent material sized to fit specific diameter of penetrant.
- d. Intumescent composite sheets: Rigid panels consisting of aluminum foil faced elastomeric sheet bonded to galvanized steel sheet.
 - e. Intumescent putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
 - f. Intumescent wrap strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
 - g. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at site to form non-shrinking, homogeneous mortar.
 - h. Pillows/bags: Reusable heat expanding pillows/bags consisting of glass fiber cloth cases filled with combination of mineral fiber, water insoluble expansion agents, and fire-retardant additives.
 - i. Silicone foams: Multicomponent, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
 - j. Silicone sealants - single component, silicone based, neutral curing elastomeric sealants of grade indicated:
 - 1) Grade: Pourable (self-leveling) formulation for openings in floors and horizontal surfaces, and non-sag formulation for openings in vertical and surfaces requiring nonslumping, gunnable sealant, unless indicated firestop system limits use to non-sag grade for both opening conditions.
- E. Fire Resistive Joint Systems: Sealants complying with UL 1479 including F, T, and L ratings.
- F. Fire Safing Insulation:
- 1. Semi-refractory blanket: Semirigid blankets designed for use as fire stops at openings between edge of slab and exterior wall panels, glass mat faced, low density; having nominal density of 4 lb/cu. ft. (64 kg/cu. m); complying with ASTM C612, Type 1A and 1B and ASTM E136 for combustion characteristics; thermal resistivity of four (4) degrees F x h x sq. ft./Btu x in. at 75 degrees F (27.7 K x m/W at 24 degrees C); with maximum flame spread and smoke developed values of 10 and 5. Use for floor perimeter fire and smoke containment. Install blanket with 20-gauge impaling clips recommended by manufacturer.
 - 2. Caulking compound: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.
 - 3. Safing clips: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.
- G. Duct Wrap for Ducts: Materials listed in the UL Fire Resistance Directory under File R8418, Category CAJ7009, File R14229 Categories CAJ 7013, CAJ 7015, CAJ 7020, CAJ 7022, YYET, and grease duct enclosures and having minimum two (2) hour fire resistive rating for grease or air duct enclosure materials.
- H. Composition Edge Banding: Materials listed in UL Fire Resistance Directory UL 10C standard.

2.2 FIRE STOPPING SYSTEMS

- A. Penetration System:
- 1. Penetrations in fire resistance rated walls - provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa):
 - a. Fire resistance rated walls include fire walls, fire barrier walls, smoke barrier walls, and fire partitions.
 - b. F Rating: Minimum fire resistance rating of constructions penetrated.

2. Penetrations in horizontal assemblies - provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa):
 - a. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
 - b. F rating: At least one (1) hour, but not less than the fire-resistance rating of constructions penetrated.
 - c. T rating: At least one (1) hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. Penetrations in smoke barriers:
 - a. Provide penetration firestopping with ratings determined per UL 1479:
 - 1) L rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
 - 2) W rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
 4. Exposed penetration firestopping: Provide products with flame-spread and smoke developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
- B. Joint Resistive Systems:
1. Joints in smoke barriers:
 - a. Provide fire resistive joint systems with ratings determined per UL 2079:
 - 1) L rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
 2. Exposed fire resistive joint systems: Provide products with flame-spread and smoke developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
 3. Exposed fire-resistive joint systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.3 MIXING

- A. For products requiring mixing before application, comply with penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install firestop systems when ambient or substrate temperatures are outside limits permitted by firestop system manufacturer or when substrates are wet due to rain, frost, condensation, or causes.
- B. Install and cure fire resistive joint systems in accordance with manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced air circulation.
- C. Ventilate firestop systems per manufacturer's written instructions by natural means or, where inadequate, forced air circulation.

3.2 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that firestop resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core drilled holes, or cut openings to accommodate penetration firestop systems.
- C. Joint System: Coordinate sizing of joints to accommodate fire resistive joint systems.
- D. Do not cover up penetration firestop system or fire resistive joint system installations that will become concealed behind other construction until building inspector of authorities having jurisdiction have examined each installation.

3.3 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and conditions affecting performance of work. Proceed with installation after unsatisfactory conditions have been corrected.

3.4 PREPARATION

- A. Surface Cleaning:
 - 1. Clean out openings immediately before installing penetration firestop systems complying with firestop system manufacturer's written instructions and with the following requirements:
 - a. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestop systems.
 - b. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - c. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by penetration firestop system manufacturer complying with manufacturer's recommended. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of work and that would be permanently stained or damaged by contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.5 INSTALLATION

- A. Penetration Firestop System:
 - 1. Install penetration firestop systems to comply with requirements and with firestop system manufacturer written installation instructions and published drawings for products and applications indicated:
 - a. Install forming/damming/backing materials and accessories of types required to support fill materials during application and in the position needed to produce cross sectional shapes and depths required to achieve fire ratings indicated. After installing fill materials and allowing them to fully cure, remove combustible forming materials and accessories not indicated as permanent components of firestop systems.

- b. Install fill materials for firestop systems by proven techniques to produce results:
 - 1) Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire resistance ratings indicated.
 - 2) Apply materials for full contact and adhere to substrates formed by openings and penetrating items.
 - 3) For fill materials that remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- B. Fire Resistive Joint System:
 - 1. Install fire resistive joint systems to comply with requirements and manufacturer's written installation instructions for products and applications indicated:
 - a. Install forming/packing/backing materials and accessories of types required to support fill materials during application and in position needed to produce cross sectional shapes and depths required to achieve fire ratings indicated.
 - b. Install fill materials for joint systems by proven techniques to produce the following results:
 - 1) Fill voids and cavities formed by openings and forming/packing/backing materials required to achieve fire resistance ratings indicated.
 - 2) Apply fill materials to contact and adhere to substrates formed by joints.
 - 3) For fill materials remaining exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.6 IDENTIFICATION

- A. Identify firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within six inches (150 mm) of edge of the firestop systems so labels are visible at removal:
 - 1. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces and, in combination with label material, resulting in partial destruction of label if removal is attempted. Include information on labels:
 - a. The words Warning - Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage.
 - b. Contractor's name, address, and phone number.
 - c. Firestop system designation of applicable testing and inspecting agency.
 - d. Date of installation.
 - e. Penetration firestop system manufacturer's name.
 - f. Installer's name.

3.7 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire resistive joint systems are damaged or removed due to testing, repair or replace fire resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire resistive joint systems with construction after inspection reports are issued and installations comply with requirements.
- D. Provide where required by code annual inspection of all fire resistive joint systems and recommendations for improvements. Include reporting with final documentation at end of project.

3.8 CUTTING AND PATCHING

- A. Cut, patch, and repair firestopping to accommodate work. Repair cracks and indented surfaces. Repair surfaces around items built into or that penetrate surfaces. Repair and replace work to eliminate blister, buckles, dry outs, and similar imperfections. Repair and replace work required to comply with fire resistance ratings.
- B. After completion of work in and around the areas of firestopping, repair and replace damaged firestopping.

3.9 CLEANING AND PROTECTION

- A. Clean excess fill materials adjacent to openings as work progresses by methods and with cleaning materials approved in writing by penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation ensuring penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestop systems immediately and install new materials to produce systems complying with requirements.

END OF SECTION 07 84 00

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Preformed joint sealants.
5. Acoustical joint sealants.

1.02 ACTION SUBMITTALS

- A. Product Data:** For each joint-sealant product indicated.
- B. Samples:** For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule:** Include the following information:
1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.03 INFORMATIONAL SUBMITTALS

- A. Product test reports.**
- B. Preconstruction compatibility and adhesion test reports.**
- C. Preconstruction field-adhesion test reports.**
- D. Field-adhesion test reports.**
- E. Warranties.**

1.04 QUALITY ASSURANCE

- A. Qualifications of Manufacturers:** Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.
- B. Qualifications of Installers:**

1. Proper caulking and proper installation of sealants require that installers be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.
2. For caulking and installation of sealants throughout the work, use only personnel who have been specifically trained in such procedures and who are completely familiar with the joint details shown on the drawings and the installation requirements called for in this section.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- B. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.02 SILICONE JOINT SEALANTS

- A. Neutral-Curing Silicone Joint Sealant ASTM C 920.
 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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
 - a. BASF Building Systems.
 - b. Dow Corning Corporation.
 - c. GE Advanced Materials - Silicones.
 - d. May National Associates, Inc.
 - e. Pecora Corporation.
 - f. Polymeric Systems, Inc.
 - g. Schnee-Morehead, Inc.
 - h. Sika Corporation; Construction Products Division.
 - i. Tremco Incorporated.
 3. Type: multicomponent
 4. Grade: nonsag (NS).
 5. Class: 100/50.
 6. Uses Related to Exposure: Traffic (T) Nontraffic (NT).

2.03 URETHANE JOINT SEALANTS

- A. Urethane Joint Sealant: ASTM C 920.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Lyntal, International, Inc.
 - d. May National Associates, Inc.
 - e. Pacific Polymers International, Inc.
 - f. Pecora Corporation.
 - g. Polymeric Systems, Inc.
 - h. Schnee-Morehead, Inc.
 - i. Sika Corporation; Construction Products Division.
 - j. Tremco Incorporated.
3. Type: multicomponent
4. Grade: nonsag (NS).
5. Class: [100/50] [50] [25].
6. Uses Related to Exposure: Traffic (T) Nontraffic (NT).

2.04 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. May National Associates, Inc.
 - d. Pecora Corporation.
 - e. Schnee-Morehead, Inc.
 - f. Tremco Incorporated..

2.05 PREFORMED JOINT SEALANTS

- A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following
 - a. Dayton Superior Specialty Chemicals.
 - b. EMSEAL Joint Systems, Ltd.
 - c. Sandell Manufacturing Co.
 - d. Schul International, Inc.
 - e. Willseal USA, LLC.

2.06 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 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:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following
 - a. Pecora Corporation .
 - b. USG Corporation..

2.07 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, [Type C (closed-cell material with a surface skin)] [Type O (open-cell material)] [Type B (bicellular material with a surface skin)] [or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated], and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.08 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.02 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.03 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

END OF SECTION

SECTION 07 95 00
EXPANSION CONTROL

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 requirements including but not limited to:
 - 1. Expansion joint cover assemblies.
 - 2. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications
 - 2. Section 07 62 00: Sheet Metal Flashing and Trim.
 - 3. Section 09 21 16: Gypsum Board Assemblies.
 - 4. Section 09 24 00: Cement Plastering.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
- B. Shop Drawings:
 - 1. Submit for each expansion joint cover assembly:
 - a. Include plans, elevations, sections, details, splices, block out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
 - b. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- C. Expansion Joint Cover Assembly Schedule:
 - 1. Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - a. Manufacturer and model number for each expansion joint cover assembly.
 - b. Expansion joint cover assembly location cross-referenced to Drawings.
 - c. Nominal, minimum, and maximum joint width.
 - d. Movement direction.
 - e. Materials, colors, and finishes.
 - f. Product options.
 - g. Fire resistance ratings.
- D. Product Test Reports: For each fire resistance rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 PERFORMANCE REQUIREMENTS

- A. Expansion Joint Design Criteria:
 - 1. Type of movement: Thermal and wind sway.

2. Refer to Drawings for placement in wall types and location of expansion joints.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Fire resistance ratings:
 - a. Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency:
 - 1) Hose stream test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate. Apply protective coating on aluminum surfaces in contact with cementitious materials.
- B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- D. Moisture Barrier: Flexible elastomeric material. Continuous, waterproof membrane within joint and attached to substrate on sides of joint. Provide where indicated on Drawings.
- E. Nonmetallic, Shrinkage Resistant Grout: ASTM C1107/C1107M, factory packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- F. Fasteners: Recommended attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 FLOOR EXPANSION JOINT COVERS

- A. Metal Plate Floor Joint Cover:
 1. Metal cover plate fixed on one side of joint gap and free to slide on other:
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) Architectural Art Manufacturing Inc. (basis of design), a division of Pittcon Architectural Metals, LLC.
 - 2) Construction Specialties, Inc.
 - 3) InPro Corporation (IPC).
 - 4) MM Systems Corporation.
 - 5) Watson Bowman Acme Corp.
 - 6) Balco.
 - b. Application: Floor to wall.
 - c. Installation: Surface mounted.
 - d. Load capacity:
 - 1) Uniform load: 50 lb/sq. ft. (244 kg/sq. m).

- 2) Concentrated load: 300 lb (136 kg).
 - 3) Maximum deflection: 0.0625 inch (1.6 mm).
 - e. Fire resistance rating: Not less than indicated on Drawings and adjacent construction.
 - f. Cover plate design: Plain.
 - g. Exposed metal: Aluminum, clear anodic, Class I.
- B. Elastomeric Seal Floor Joint Cover:
- 1. Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) Architectural Art Manufacturing Inc.
 - 2) Construction Specialties, Inc.
 - 3) EMSEAL Joint Systems, Ltd.
 - 4) InPro Corporation (IPC).
 - 5) MM Systems Corporation.
 - 6) Watson Bowman Acme Corp.
 - 7) Balco.
 - b. Application: Floor to floor.
 - c. Installation: Indicated on Drawings.
 - d. Load capacity:
 - 1) Uniform load: 50 lb/sq. ft. (244 kg/sq. m).
 - 2) Concentrated load: 300 lb (136 kg).
 - 3) Maximum deflection: 0.0625 inch (1.6 mm).
 - e. Fire resistance rating: Not less than that indicated on Drawings and adjacent construction.
 - f. Exposed metal: Aluminum, clear anodic, Class I.
 - g. Seal: Preformed elastomeric membrane or extrusion.

2.3 WALL EXPANSION JOINT COVERS

- A. Metal Plate Wall Joint Cover:
- 1. Metal cover plate fixed on one side of joint gap and free to slide on other:
 - a. Manufacturers are subject to compliance with requirements, provide products by one of the following:
 - 1) Architectural Art Manufacturing Inc., a division of Pittcon Architectural Metals, LLC.
 - 2) Construction Specialties, Inc.
 - 3) InPro Corporation (IPC).
 - 4) MM Systems Corporation.
 - 5) Watson Bowman Acme Corp.
 - 6) Balco.
 - b. Application: Wall to wall.
 - c. Fire resistance rating: Not less than indicated on Drawings and adjacent construction.
 - d. Exposed metal: Aluminum, clear anodic, Class I.

2.4 CEILING EXPANSION JOINT COVERS

- A. Metal Plate Ceiling Joint Cover:
- 1. Metal cover plate fixed on one side of joint gap and free to slide on other:
 - a. Manufacturers are subject to compliance with requirements, provide products by one of the following:
 - 1) Architectural Art Manufacturing Inc.
 - 2) Construction Specialties, Inc.
 - 3) InPro Corporation (IPC).

- 4) MM Systems Corporation.
- 5) Balco.
- b. Application: Wall to ceiling.
- c. Fire resistance rating: Not less than indicated on Drawings and adjacent construction.
- d. Exposed metal: Aluminum, Clear anodic, Class I.

2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.
- C. Furnish units in longest practicable lengths to minimize field splicing.
- D. Include factory fabricated closure materials and transition pieces, T joints, corners, curbs, cross connections, and other accessories as required to provide continuous expansion joint cover assemblies.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames:
 - 1. Perform cutting, drilling, and fitting required to install expansion joint cover assemblies:
 - a. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage resistant grout.
 - b. Install frames in continuous contact with adjacent surfaces.
 - c. Shimming is not permitted.
 - d. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - e. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.

- f. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - g. Locate anchors at interval recommended by manufacturer, but not less than three inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.
- C. Seals:
 - 1. Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints:
 - a. Provide in continuous lengths for straight sections.
 - b. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 - c. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure sensitive tape as recommended by manufacturer.
- D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- E. Terminate exposed ends of expansion joint cover assemblies with field or factory fabricated termination devices.
- F. Fire Resistance Rated Assemblies:
 - 1. Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements:
 - a. Fire barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.

3.4 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 00

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

- 1. Standard and custom hollow metal doors and frames.
 - 2. Steel sidelight, borrowed lite and transom frames.
 - 3. Louvers installed in hollow metal doors.
 - 4. Light frames and glazing installed in hollow metal doors.

- B. Related Sections:

- 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
 - 4. Division 08 Section "Door Hardware".
 - 5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 - 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Security Metal Products (SMP).

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.

6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.

2.04 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) – M Series.
- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

- 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.06 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal components.

2.07 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
 - 1. Blade Type: Vision proof inverted V or inverted Y.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.08 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.09 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
 - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.11 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jamb and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply

touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

SECTION 08 14 23.16

PLASTIC LAMINATE FACED WOOD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

- 1. Solid core doors with high pressure decorative laminate faces.
 - 2. Factory fitting wood doors to frames and factory machining for hardware.
 - 3. Louvers installed in flush wood doors.
 - 4. Light frames and glazing installed in wood doors.

- B. Related Sections:

- 1. Division 08 Section "Hollow Metal Doors and Frames" for wood doors in steel frames.
 - 2. Division 08 Section "Glazing" for glass view panels in wood doors.
 - 3. Division 08 Section "Door Hardware" for door hardware for flush wood doors and wood frames.

- C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI A208.1 – Wood Particleboard.
 - 2. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
 - 3. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
 - 4. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
 - 5. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
 - 6. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.03 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A or AWS classifications. Include factory finishing specifications.

B. Shop Drawings shall include:

1. Indicate location, size, and hand of each door.
2. Indicate dimensions and locations of mortises and holes for hardware.
3. Indicate dimensions and locations of cutouts.
4. Indicate requirements for veneer matching.
5. Indicate location and extent of hardware blocking.
6. Indicate construction details not covered in Product Data.
7. Indicate doors to be factory finished and finish requirements.
8. Indicate fire protection ratings for fire rated doors.

C. Warranty: Sample of special warranties.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.06 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction and delaminating of face.
 2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.
 3. Warranty Period for Solid Core Interior Doors: Life of installation according to manufacturer's written warranty.

PART 2 - PRODUCTS

2.01 DOOR CONSTRUCTION – GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Custom.
- B. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.
 - 1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60, and 90-minute rated doors. Comply with specified requirements for exposed edges.
 - 2. Pairs: Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - a. Where required or specified, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.

2.02 CORE CONSTRUCTION

- A. Structural Composite Core Wood Doors:
 - 1. Structural Composite Lumber: Engineered hardwood composite wood products tested in accordance with WDMA I.S.1A, Testing Cellulosic Composite Materials for Use in Fenestration Products containing no added Urea Formaldehyde. Comply with minimum performance levels below:
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 550 lbf (2440 N).
 - 2. LEED: Meet requirements of EQ4.4.
 - 3. Sound Transmission Class: Have an operable STC rating of 30.
- B. Particleboard Core Doors:
 - 1. Particleboard: Wood fiber-based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
 - 2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.
 - 3. Blocking: As indicated under article "Blocking".
- C. Fire Resistant Composite Core Doors:
 - 1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
 - 2. Blocking: As indicated under article "Blocking".

3. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance. Comply with specified requirements for exposed edges.

2.03 BLOCKING

A. Fire Rated Doors:

1. Provide blocking as indicated below:
 - a. HB1: 5 inch in doors indicated to have closers and overhead stops.

2.04 PLASTIC LAMINATE FACED WOOD DOORS

A. Manufacturers (Standard Doors): Subject to compliance with requirements, provide products by one of the following:

1. ASSA ABLOY Wood Doors (GR): GPD
2. Eggers Industries (EG): Premium
3. Marshfield (MF): Signature
4. VT Industries (VT): Artistry

2.05 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040-inch-thick, factory primed for paint finish with baked enamel or powder coated finish.

2.06 LIGHT FRAMES AND GLAZING

A. Metal Frames for Light Openings in Fire Rated Doors over 20-minute Rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.

1. Manufacturers:
 - a. Air Louver (LV).
 - b. All Metal Stamping (AP).
 - c. Anemostat (AN).
 - d. Pemko (PE).

B. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

2.07 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

PLASTIC LAMINATE FACED WOOD DOORS

1. Comply with requirements in NFPA 80 for fire rated doors.
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
- D. Openings: Cut and trim openings through doors in factory.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
 3. Louvers: Factory install louvers in prepared openings.
- E. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.
- C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

3.03 ADJUSTING

- A. Operation: Re-hang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.
 - 2. Floor access doors and frames.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material.
- D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 tested according to the following test method:
 - 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 - 2. NFPA 288 for fire-rated access door assemblies installed horizontally.
 - 3. Continuous hinges shall not obscure fire rating labels of doors or door frames.

2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
 - 1. Access Panel Solutions.
 - 2. Acudor Products, Inc.
 - 3. Alfab, Inc.
 - 4. Babcock-Davis.

5. Cendrex Inc.
 6. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
 7. Jensen Industries; Div. of Broan-Nutone, LLC.
 8. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 9. Karp Associates, Inc.
 10. Larsen's Manufacturing Company.
 11. Maxam Metal Products Limited.
 12. Metropolitan Door Industries Corp.
 13. MIFAB, Inc.
 14. Milcor Inc.
- C. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- D. Flush Access Doors with Exposed Flanges
1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and ceiling .
 3. Door Size: On drawings.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage
 - a. Finish: Factory prime
 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage.
 - a. Finish: Factory prime.
 6. Frame Material: Same material, thickness, and finish as door
 7. Hinges: Manufacturer's standard
 8. Hardware: Lock.
- E. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board plaster beads for concealed flange installation.
 2. Locations: Wall and ceiling
 3. Door Size: On drawings
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage
 - a. Finish: Factory prime
 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage
 - a. Finish: Factory prime.
 6. Frame Material: Same material and thickness as door
 7. Hinges: Manufacturer's standard
 8. Hardware: Lock.

F. Recessed Access Doors

1. Assembly Description: Fabricate door in the form of a pan recessed 5/8 inch for gypsum board and 1 inch for plaster infill. Provide frame with gypsum board bead for concealed flange or plaster bead for concealed flange installation.
2. Locations: Wall and ceiling.
3. Door Size: On drawings
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage
 - a. Finish: Factory prime.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage
 - a. Finish: Factory prime
6. Frame Material: Same material and thickness as door.
7. Hinges: Manufacturer's standard .
8. Hardware: Lock.

G. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling
3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
5. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime
6. Frame Material: Same material, thickness, and finish as door
7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

H. Fire-Rated, Flush Access Doors with Concealed Flanges

1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling
3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
5. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime
6. Frame Material: Same material, thickness, and finish as door

7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

I. Hardware:

1. Latch: Cam latch by flush key
2. Lock: Cylinder

2.03 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- E. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- F. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- G. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness according to ANSI H35.2.
- H. Frame Anchors: Same type as door face.
- I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.04 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder locks, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.05 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.02 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 33 00

OVERHEAD COILING SERVICE DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Overhead coiling service doors; insulated and non-insulated.

1.02 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications
- B. Section 06 20 00 - Finish Carpentry
- C. Section 08 71 00 - Door Hardware
- D. Section 09 91 23 - Painting
- E. Division 26 Electrical

1.03 REFERENCES

- A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. NEMA MG 1 - Motors and Generators.

1.04 DESIGN / PERFORMANCE REQUIREMENTS

- A. Overhead coiling service doors:
 - 1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components.
 - 2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

- B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 - Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Details of construction and fabrication.
 - 4. Installation instructions.
- C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

1.08 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.

1.09 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com.
- B. Substitutions: Cookson Company.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 - Substitution Procedures.

2.02 ROLLING STEEL COUNTER DOORS

- A. Light Commercial Doors: Overhead Door Corporation, 600 Series Coil-Away Service Doors.
 - 1. Curtain: Interlocking roll-formed galvanized steel slats, flat crown profile type CAW, 24 gauge. End of each slat shall be locked from lateral movement by a staking lock system. (Galvanized alternate malleable end locks.)
 - 2. Finish:
 - a. Curtain slats and hood shall be galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
 - 1) Powder coat: PowderGuard
 - a) PowderGuard Premium: Weather resistant polyester powder coat color as selected by the Architect Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
 - 3. Weatherseals: Vinyl bottom seal.
 - 4. Bottom Bar: Extruded aluminum.
 - 5. Guides: Roll-formed galvanized steel shapes attached to continuous galvanized steel wall angle.

- a. Finish: PowderGuard Zinc Finish for guides, bottom bar and head plate.
- 6. Brackets: Galvanized steel to support counterbalance and curtain.
- 7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel and supporting the curtain with deflection limited to 0.03 inch per foot of span. Spring tension shall be adjustable.
- 8. Hood: 24 gauge galvanized steel with intermediate supports as required.
- 9. Manual Operation:
 - a. Chain hoist for doors over 100 SF.
- 10. Locking:
 - a. Chain keeper locks for chain hoist operation.
- 11. Wall Mounting Condition: Face-of-wall.

2.03 INSULATED OVERHEAD COILING SERVICE DOORS

- A. Overhead Coiling Stormtite Insulated Service Doors: Overhead Door Corporation 625 Series.
 - 1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
 - a. Flat profile type F-265i for doors up to 40 feet (12.19 m) wide.
 - b. Front slat fabricated of:
 - 1) 22 gauge galvanized steel.
 - c. Back slat fabricated of:
 - 1) 24 gauge galvanized steel.
 - d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
 - 1) R-Value: 7.7, U-Value: 0.13.
 - 2) Sound Rating: STC-21.
 - 2. Finish:
 - a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
 - 1) Powder coat: PowderGuard
 - a) PowderGuard Premium: Weather resistant polyester powder coat color as selected by the Architect.

- 2) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
3. Weatherseals:
 - a. Vinyl bottom seal, exterior guide and internal hood seals.
 - b. Interior guide weatherseal.
 - c. Lintel weatherseal.
4. Bottom Bar:
 - a. Two galvanized steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.
5. Guides: Three Structural steel angles.
 - a. Finish: PowderGuard Zinc Finish for guides, bottom bar and head plate.
6. Brackets:
 - a. Galvanized steel to support counterbalance, curtain and hood.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
8. Hood: Provide with internal hood baffle weatherseal.
 - a. 24 gauge galvanized steel with intermediate supports as required.
9. Manual Operation:
 - a. Chain hoist.
10. Windload Design:
 - a. Standard windload shall be 20 PSF.
11. Locking:
 - a. Chain keeper locks for chain hoist operation.
12. Wall Mounting Condition:
 - a. Face-of-wall mounting.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00 - Joint Sealants.
- F. Install perimeter trim and closures.
- G. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

3.04 ADJUSTING

- A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
 - 1. Division 08: Section - Hollow Metal Doors and Frames.
 - 2. Division 08: Section - Flush Wood Doors.

1.3 REFERENCES

- A. 2022 California Building Code, CCR Title 24, Part 2
- B. BHMA - Builders' Hardware Manufacturers Association
- C. DHI - Door and Hardware Institute
- D. NFPA - National Fire Protection Association.
 - 1. NFPA 80 - Fire Doors and Other Opening Protectives
 - 2. NFPA 105 - Smoke and Draft Control Door Assemblies
- E. UL - Underwriters Laboratories.
 - 1. UL 10C - Fire Tests of Door Assemblies
 - 2. UL 305 - Panic Hardware
- F. WHI - Warnock Hersey Incorporated
- G. SDI - Steel Door Institute

1.4 SUBMITTALS & SUBSTITUTIONS

- A. General: Submit in accordance with Conditions of the Contract and Division 01 Specification sections.
- B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

- C. Submit electronic PDF copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
1. Include a Cover Sheet with:
 - a. Job Name, location, telephone number.
 - b. Architects name, location and telephone number.
 - c. Contractors name, location, telephone number and job number.
 - d. Suppliers name, location, telephone number and job number.
 - e. Hardware consultant's name, location and telephone number.
 2. Job Index information included:
 - a. Numerical door number index including; door number, hardware heading number and page number.
 - b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
 - c. Manufacturers' names and abbreviations for all materials.
 - d. Explanation of abbreviations, symbols, and codes used in the schedule.
 - e. Mounting locations for hardware.
 - f. Clarification statements or questions.
 - g. Catalog cuts and manufacturer's technical data and instructions.
 3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number - HW Group #1)				
(a) 1 Single - Door #101 - Corridor 101 to Exterior			(b) 90°	(c) RH
(d) 3'-0" x 7'-0" x 1-3/4" - Wood Door x Hollow Metal Frame - 20 Minute				
(e) 1.	(f) 3 ea	(g) Hinges - (h) 5BB1 4.5 x 4.5 NRP	(i) 1/2 TMS	(j) 630
2.	1 ea	Lockset - ND80P6D x RHO x RH x 10-025 x JTMS		(k) IVE
3.	1 ea	Closer - 4040XP x EDA x TBSRT		SCH
			689	LCN

- (a) Single or pair of doors with opening number and location.
- (b) Degree of opening.
- (c) Hand of door(s).
- (d) Door/frame dimensions and material; Label requirements, if any.
- (e) Hardware item line # (Optional).
- (f) Quantity.
- (g) Product description.
- (h) Product part number.
- (i) Fastenings and other pertinent information.
- (j) Hardware finish codes per ANSI/BHMA A156.18.
- (k) Manufacturer abbreviation.

- D. Make substitution requests in accordance with Division 01. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

- F. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- G. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.
- H. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.
- I. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.5 QUALITY ASSURANCE

- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
 - 1. Responsible for detailing, scheduling and ordering of finish hardware.
 - 2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.
 - 3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
 - 1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- F. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.

- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.
- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.

1.7 WARRANTY

- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
 - 1. Locksets: Ten (10) years.
 - 2. Exit devices: Three (3) years.
 - 3. Closers: Thirty (30) years.
 - 4. All other hardware: Two (2) years.

1.8 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.9 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference at least one week prior to beginning work of this section.
- B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key Owner's Personnel, and Project Inspector.
- C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review Owner's keying standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	None – District Standard
Exit Devices	Von Duprin	None – District Standard
Closers	LCN	None – District Standard
Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI
Door Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.2 MATERIALS

- A. Hinges:
1. Provide hinges conforming to ANSI/BHMA A156.1.
 2. Hinges shall be sized in accordance with the following:
 - a. Height:
 - 1) Doors up to 42" wide: 4-1/2 inches.
 - 2) Doors 43" to 48" wide: 5 inches.
 - b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
 - c. Number of Hinges: Provide 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
 3. Exterior out-swinging hinges shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
 4. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.
- B. Continuous Hinges:
1. Provide aluminum geared continuous hinges fabricated from 6063-T6 aluminum conforming to ANSI/BHMA A156.26, Grade 1.
 2. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
 3. Provide continuous hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
 4. Provide continuous hinges 1" shorter in length than nominal height of door, unless otherwise noted, with symmetrical hole pattern.
 5. Install continuous hinges with fasteners supplied by manufacturer.
- C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" lever design.
1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
 2. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive locked lever torque – minimum 3,100 inch-pounds without gaining access.
 - b. Offset lever pull – minimum 1,600 foot pounds without gaining access.
 - c. Vertical lever impact – minimum 100 impacts without gaining access.
 - d. Cycle Test – tested to minimum 16 million cycles with no visible lever sag; without the use of performance aids such as set screws or spacers.
 3. Cylinders: Refer to "KEYING" article, herein.
 4. Provide locks with standard 2-3/4" backset, unless noted otherwise, with 1/2" latch throw. Provide proper latch throw for UL listing at pairs.
 5. Provide locksets with separate solid steel anti-rotation thru-bolts, and no exposed screws.
 6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 9. Provide levers with vandal resistant technology as scheduled for use at abusive applications.
- D. Exit devices: Von Duprin as scheduled.
1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
 2. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 standards.

3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
 4. Provide exit devices cut to door width and height. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
 5. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
 6. Provide flush end caps for exit devices.
 7. Exit devices shall comply with CBC Section 11B-404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
 8. Provide exit devices UL certified to meet 5 lbs. maximum unlatching force requirements according to the CBC Section 11B-309.4.
 9. Cylinders: Refer to "KEYING" article, herein.
 10. Provide cylinder dogging as specified at non fire-rated openings. Provide cylinder dogging indicators (CDSI) for visible indication of dogging status as specified.
 11. Removable Mullions: Provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
 12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
 13. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
 14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
 15. Provide exit devices with manufacturer's approved strikes.
 16. Panic hardware shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met per DSA Interpretation 10-08 DSA/AC. Such conditions must be clearly demonstrated and indicated in the specification:
 - a. Panic hardware contains a "dogging" feature and during the time the facility is open the panic hardware shall be "dogged".
 - b. The act of "dogging" a door in the open position shall only be performed by employees as a part of their job function (non-public use).
- E. Closers: LCN as scheduled.
1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
 3. Provide certificate by independent testing laboratory that door closers have completed over 10,000,000 cycles and can still meet ANSI/BHMA A156.4 standards.
 4. Cylinder Body: 1-1/2" diameter with 3/4" diameter double heat-treated pinion journal.
 5. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120° F to -30° F.
 6. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
 7. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
 8. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
 9. Pressure Relief Valve (PRV) Technology: Not permitted.
 10. Provide door closers powder coated to match balance of door hardware. Powder coating finish shall be certified to exceed 100 hours salt spray testing as described in ANSI/BHMA A156.4 and ASTM B117.
 11. Provide special rust inhibitor (SRI) in highly corrosive areas, and where noted in hardware sets.

12. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
- F. Flush Bolts & Dust Proof Strikes:
 1. Automatic flush bolts shall be of the low operating force design.
 2. Provide top bolt only model for interior doors where applicable and as permitted by testing procedures.
 3. Provide dust proof strikes at openings using bottom bolts.
 4. Manual flush bolts shall only be permitted on storage or mechanical openings, as scheduled.
- G. Door Stops:
 1. Unless otherwise noted in hardware sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
 2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
 3. Provide backing plate at wall framing behind wall type.
 4. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions. Stop-only function shall be provided at fire-rated openings.
- H. Protection Plates:
 1. Provide kick, mop, and/or armor plates minimum of 0.050" thick, with four beveled edges. Furnish with sheet metal or wood screws, finished to match plates.
 2. Kick plates shall be sized 10" high and 2" less door width (LDW) at single doors and 10" high and 1" LDW at pairs or doors.
 3. Provide mop and armor plates with sizes as scheduled in hardware sets.
- I. Thresholds: As scheduled and per details.
 1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope. Thresholds shall comply with CBC Section 11B-404.2.5.
 2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 07 "Thermal and Moisture Protection".
 3. Use 1/4" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
- J. Seals: Provide silicone gasket at all rated and exterior doors.
 1. Smoke & Draft Control Doors: Provide UL10C Classified gasketing that complies with NFPA 80 & NFPA 252 for use on "S" labeled Positive Pressure door assemblies.
- K. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.3 KEYING

- A. Furnish a proprietary Schlage Restricted masterkey system as directed by the Madera Unified School District lock shop. Key system to be designated and combined by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer.
- B. A detailed keying schedule is to be prepared by the District lock shop in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.

- C. Furnish all cylinders in the Schlage Full Size Interchangeable Core (FSIC) format. Pack change keys independently (PKI). Verify Restricted Numbered keyway with District lock shop.
- D. Furnish construction keying for doors requiring locking during construction.
- E. Furnish all keys with visual key control.
 - 1. Stamp key "Do Not Duplicate".
 - 2. Stamp (BHMA) key symbol on key.
 - 3. Stamp unique owner identifier from the key bow.
- F. Furnish mechanical keys as follows:
 - 1. Furnish 2 cut change keys for each different change key code.
 - 2. Furnish 1 uncut key blank for each change key code.
 - 3. Furnish 6 cut masterkeys for each different masterkey set.
 - 4. Furnish 3 uncut key blanks for each masterkey set.
 - 5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
 - 6. Furnish 1 cut control key cut to each SKD combination.
- G. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
 - 1. Furnish KS43F3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 FSIC core with above.
- H. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.
 - 1. Furnish CL777R for use with FSIC Schlage cylinders.

2.4 FINISHES

- A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
- C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
- D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.5 FASTENERS

- A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.

- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
- G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by DHI. Operating hardware shall be located between 34" and 44" above finish floor to comply with CBC Section 11B-404.2.7.
- D. Door Closers:
 - 1. Place door closers inside building, stairs, rooms, etc. Closers shall be installed to permit doors to swing 180 degrees or maximum allowable by conditions.
 - 2. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors.
 - 3. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal.
 - 4. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
 - 5. Compensating devices or automatic door operators may be utilized to meet the above standards.
 - 6. Per CBC Section 11B-404.2.8.1, doors shall take minimum of 5 seconds to move from an open position of 90 degrees to 12 degrees to the latch jamb.
- E. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- G. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
- H. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

- A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.5 FIELD QUALITY CONTROL

- A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.6 HARDWARE SCHEDULE

- A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.
- B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.
- C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

MANUFACTURERS ABBREVIATIONS

IVE	=	Ives	Hinges, Flush Bolts, Door Stops, Kick Plates & Silencers
LCN	=	LCN	Door Closers

SCH	=	Schlage Lock	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

HW GROUP NO: 01 – (101A, 101D, 109A, 109B, 124A, 124B, 128A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 02 – (101E)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 03 – (122A, 125A, 129A, 130A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM SEC	ND95TD RHO XN12-035	626	SCH
2	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 04 – (102B)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM SEC	ND95TD RHO XN12-035	626	SCH
2	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 05 – (115A, 117A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM LOCK	ND94TD RHO	626	SCH
1	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 06 – (111A, 123A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 07 – (114A, 116A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 08 – (112A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FAC RESTRM W/IND CYL	ND85PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-000 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 09 – (113A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FAC RESTRM W/IND CYL	ND85PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-000 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 10 – (132A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	CONT. HINGE	224XY	628	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT (ON ACTIVE LEAF ONLY)	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	ASTRAGAL	43SP	SP	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO: 11 – (104A, 104B, 118A, 118B, 128B)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY	ND75JD RHO XN12-035	626	SCH
2	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS45	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO: 12 – (102A, 102C, 125B, 129B, 130B)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50JD RHO	626	SCH
1	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO: 13 – (103A, 126A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO: 14 – (106A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO: 15 – (105A, 107A, 108A, 120A, 121A, 131A)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ADA STOREROOM LOCK	ND81JD RHO	626	SCH
1	EA	FSIC CORE	23-030 NUM	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO: 16 – (132B)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	MANUAL FLUSH BOLT	FB358	626	IVE
1	EA	ADA STOREROOM LOCK	ND81JD RHO	626	SCH
1	EA	FSIC CORE	23-030 NUM	626	SCH
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS436	626	IVE
2	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO: 17 – (101B, 101C, 122B, 122C)

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	MORTISE/RIM CYLINDER	SCHLAGE TYPE AS REQUIRED		SCH
1	EA	FSIC CORE	23-030 NUM	626	SCH
			BALANCE OF HARDWARE BY ROLL-UP DOOR MFR		

END OF SECTION 08 71 00

SECTION 08 80 00
GLASS AND GLAZING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included: Provide all glass and glazing, complete, in place, as shown on the Drawings, specified herein, or needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

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

1.03 SUBMITTALS

- A. Product Data: Per the General Conditions - Submittals Procedures:
 - 1. Complete materials list showing all items proposed to be furnished and installed under this Section.
 - 2. Sufficient data to demonstrate that all such materials meet or exceed the specified requirements.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the review by the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General:
 - 1. Conform to Codes, and additional requirements stated herein.
 - 2. Glazing:
 - a. Title 24, Chapter 24.

- b. Glazing; Glass: Title 24, Section 2403 of CBC 2022, which is based on Federal Specifications DD-G-00451 b.
- c. Safety Glazing: Title 24, Section 2406, of 2016 CBC (which is based on ANSI Z97.1-2014, and CPSC 16CFR Part 1201).

B. Glass:

- 1. Acceptable Manufacturers: ASG Industries Company, Ford Glass Division, Globe-Amerada Glass Company, Libby-Owens-Ford and PPG Industries. Interior glazing is single glazed, exterior glazing is dual glazed insulating units. Thickness (unless otherwise noted): 3/16" thick for openings to 12 SF maximum, 7/32" thick for openings to 30 SF maximum, 1/4" for larger openings.
- 2. Types: Named manufacturer and product shall be a standard of quality:
 - a. Interior Glazing: Clear, transparent tempered or non-tempered glass.
 - b. Exterior Glazing: PPG Solarban 60 (2) Optigray tempered or non-tempered outside, clear tempered or non-tempered inside. (VLT = 50%, SHGC = 0.30, Summer U-Value 0.27)
 - c. 45 minute glazing, Superlite 1 XL glazing by Safti-First
 - d. 60 minute interior glazing, Superlite 2 XL 60 glazing by Safti-First
 - e. Refer to Spec Section 08 87 13 – Solar Control Films

C. Glazing Accessories:

- 1. Conform to FGMA "Glazing Sealing Systems Manual" and/or printed recommendations by glass or plastic glazing materials manufacturer, whichever is most stringent, for:
 - a. Setting blocks
 - b. Spacers
 - c. Glazing Points
 - d. Glazing Compound
 - e. Sealant
 - f. Glazing Tape

D. Aluminum Glazing Accessories: U.S. Aluminum products as a standard of quality.

- 1. Glazing Stops and H-Bars:
 - a. General:
 - 1) Material: Extruded aluminum, 6063-T5 alloy.
 - 2) Finish: Satin, anodized finish of specified color.
 - b. Glazing Stops: Arcadia No. 22-103, unless otherwise noted.

- 1) Glazing Beads: Roll-in, non-stretch, high-shore vinyl with a 60# test fiberglass cord concealed-in and bonded to the vinyl.
- 2) No exposed screws in stop system.

E. Oversized Mirrors:

1. Mirrors: 1/4" tempered, clear, transparent flat glass of mirror quality (Type I, Class 1, quality q2), silvered with nitrate-of-silver, electro-plated with copper to completely seal silver from contact with air, painted with black hard composition paint. Grind and polish exposed edges.
2. Ledge Molding: Extruded anodized aluminum J-molding with "1/2" short and 1" long legs.

F. Acoustical Glazing

1. See section 08 56 70 Sound Control Windows.

G. Safety Glazing

1. Each pane shall bear the manufacturer's mark designating the type and thickness of the glass or glazing material. The identification shall not be omitted unless approved and an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with approved construction documents that comply with the provisions of this chapter. Safety glazing shall be identified in accordance with Section 2406.3 of CBC. Each pane of tempered glass, except tempered spandrel glass, shall be permanently identified by the manufacturer. The identification mark shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed. Tempered spandrel glass shall be provided with a removable paper marking by the manufacturer. Where required by other sections of this code, glazing shall be tested in accordance with CPSC 16 CFR Part 1201. Glazing shall comply with the test criteria for Category II, unless otherwise indicated in Table 2406.2(1).
2. The construction documents and analysis or test data required per Section 2406.2 shall be submitted to the enforcement agency for approval.
3. Glass firmly supported on all four edges shall be glazed with minimum laps and edge clearances set forth in Table 2403.2.1. of CBC.

2.02 FACTORY FABRICATION OF GLASS

A. General:

1. Factory fabricate to exact sizes required for each opening for all tempered glass.
2. Fabricate per Code, FGMA, SIGMA and manufacturer's printed recommendations.
 - a. Provide Code required edge clearances.

- b. Tinted glass to have clean-cut edges.
- B. Labeling: Label glazing per Title 24, Section 2402. Tempered glass to have permanently etched label. Labeling of safety glazers to be per 2022 CBC Section 2406.3.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Selection of Glass: Where plate glass is indicated or specified, float glass may be used.
- B. Distortion: Cut and install glass with the visible lines or waves running with the horizontal direction.
- C. Fix movable items securely, or in a closed and locked position, until glazing compound has thoroughly set.
- D. Glass Setting:
 - 1. Items to be glazed shall be shop-glazed or field-glazed with glass of the quality and thickness specified.
 - 2. Prepare surrounds and glass, unless otherwise directed, in conformance with the details and general conditions governing glazing in the FGMA Glazing Manual.
 - 3. Aluminum windows and wood doors may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except the face puttying method illustrated and described in CS 163 will not be permitted.
 - 4. Use beads or stops furnished with the items to be glazed to secure the glass in place.

3.03 CLEANING

- A. Prior to acceptance of the work, thoroughly clean all glass and remove all labels, paint spots, putty, and other defacements.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Gypsum Board.
 - 2. Reinforced Gypsum Board Sheathing (Tile Backer Board).
 - 3. Cementitious Backer Units.
 - 4. Impact Resistant Gypsum Board.
 - 5. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 08 11 13: Hollow Metal Doors and Frames.
 - 4. Section 08 31 13: Access Door and Frames.
 - 5. Section 09 30 00: Tiling.
 - 6. Section 09 91 23: Painting.

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with manufacturer's load tables and the following design pressures and deflections:
 - 1. Stairs, Elevator Hoistways, and Vertical Shafts: 1/120 at 10 psf.
 - 2. Ground Floor Lobbies: 1/120 at 15 psf.
 - 3. Partitions Receiving Stone Cladding, Lath and Plaster, or Plaster Veneer: 1/360 at 15 psf.
 - 4. Partitions Receiving Monitors, Televisions, Heavy Audio/Visual Equipment: 1/360 at 15 psf.
 - 5. Typical Partitions: 1/240 at 5 psf.
 - 6. Other Partitions - 1/240 at 5 psf.:
 - a. Maximum Deflection:
 - 1) L/240 at 5 lbf per sq. ft.
 - 2) L/120 at 5 lbf per sq. ft.
 - 3) L/120 at 7.5 lbf per sq. ft.
 - 4) L/120 at 10 lbf per sq. ft.
- B. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- 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.

1.4 SUBMITTALS

- A. Product Data: Submit For each type of drywall including calculations for loadings and stresses of exterior walls and specially fabricated framing based on manufacturer's load tables.
- B. Shop Drawings: Indicate locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
- C. Samples:
 - 1. Trim Accessories: Full size Sample in 12-inch (300 mm) long length for each trim accessory indicated.
 - 2. Textured Finishes: 12 inches by 12 inches (300 mm by 300 mm) for each textured finish indicated and on same backing indicated for Work.
- D. Calculations: Submit calculations verifying steel partition stud minimum base metal thickness and depth compliance with Code and ASTM C645 for height, load, and deflection.
- E. Evaluation Reports: ICC-ES reports for dimpled steel studs and runners and firestop tracks.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with applicable requirements of CBC for interior finishes.
 - 2. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. Single Source Responsibility:
 - 1. Framing Members: Obtain steel framing members from single manufacturer.
 - 2. Panel Products: Obtain each type of gypsum board and other panel products from single manufacturer.
 - 3. Finishing Materials: To the extent possible, obtain finishing materials from same manufacturer supplying gypsum board products. When not possible, obtain materials from manufacturer acceptable to gypsum board manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1. Steel Studs and Tracks:
 - a. ClarkDietrich
 - b. CEMCO; California Expanded Metal Products Co.
 - c. Custom Stud.

- d. MBA Building Supplies.
- e. MRI Steel Framing, LLC.
- f. Phillips Manufacturing Co.
- g. SCAFCO Steel Stud Co.
- h. Steel Network, Inc. (The).
- i. Telling Industries.
- 2. Ceiling Grid:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640-C.
- 3. USG Corporation; Drywall Suspension System.
- 4. Gypsum Board:
 - a. CertainTeed Corporation.
 - b. Georgia Pacific.
 - c. National Gypsum Company.
 - d. USG Corporation.
- 5. Tile Backer Board: Fiberock Interior Aqua-Tough; USG Corporation or comparable product.
- 6. Glass Mat Gypsum Sheathing Board:
 - a. CertainTeed Corporation; GlasRoc.
 - b. G-P Gypsum Corporation; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond e(2)XP.
 - d. United States Gypsum Co.; Securock.
- 7. Cementitious Board:
 - a. CertainTeed Corporation.
 - b. Custom Building Products.
 - c. National Gypsum Company.
 - d. United States Gypsum Company.
- B. Framing Members:
 - 1. ASTM C754 for component sizes and conditions under specified maximum deflection and lateral loading conditions indicated:
 - a. Steel Sheet Components: Comply with ASTM C645 requirements for metal.
 - b. Protective Coating: ASTM A653/A653M, G60 (Z180), hot dip galvanized.
- C. Steel Framing Components:
 - 1. ASTM C754 for conditions indicated; hot dip galvanize complying with ASTM A653 Z180:
 - a. Steel Studs and Runners: ASTM C645, 0.0179 inch (0.45 mm) minimum base metal thickness; Depth indicated on Drawings.
 - b. Dimpled Steel Studs and Runners: ASTM C645, equivalent to minimum base metal thickness indicated on Drawings for depth indicated on Drawings.
 - c. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
 - d. Cold Rolled Channel Bridging: 0.0538 inch (1.37 mm) bare steel thickness, with minimum 1/2 inch (12.7 mm) wide flanges. Depth indicated on Drawings.
 - e. Clip Angle: Not less than 1-1/2 inch by 1-1/2 inch (38.1 mm by 38.1 mm), 0.068-inch (1.73 mm) thick, galvanized steel.
 - f. Hat Shaped, Rigid Furring Channels: ASTM C645; 0.0179-inch (0.45 mm) minimum base metal thickness; Depth indicated on Drawings.
 - g. Resilient Furring Channels: 1/2-inch (12.7mm) deep, steel sheet members designed to reduce sound transmission. Configuration: Asymmetrical or hat shaped.
 - h. Cold Rolled Furring Channels - 0.0538-inch (1.37mm) bare steel thickness, with minimum 1/2-inch (12.7mm) wide flanges:
 - 1) Depth: Indicated on Drawings.

- 2) Furring Brackets: Adjustable, corrugated edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
 - 3) Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625-inch (1.59mm) diameter wire, or double strand of 0.0475-inch (1.21mm) diameter wire.
 - i. Z Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
 - j. Auxiliary Framing Materials: Fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
 - k. Slip Type Head Joints - Where indicated, provide one of the following:
 - 1) Single Long Leg Runner System: ASTM C645 top runner with 2-inch (50.8 mm) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging, located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 - 2) Double Runner System: ASTM C645 top runners, inside runner with 2-inch (50.8 mm) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - 3) Deflection Track - Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide one of the following:
 - a) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - b) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
 - c) Superior Metal Trim; Superior Flex Track System (SFT).
 - l. Firestop Tracks:
 - 1) Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire resistance rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide one of the following:
 - a) Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 - b) Grace Construction Products; FlameSafe FlowTrak System.
 - c) Metal-Lite, Inc.; The System.
 - d) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series as applicable.
- D. Gypsum Board - ASTM C1396/C1396M, applicable to type of gypsum board indicated and whichever is more stringent:
- 1. Core - Use Type X throughout:
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
 - 2. Ceiling Type - Manufactured for sag resistance:
 - a. Thickness: 1/2 inch (13mm).
 - b. Long Edges: Tapered.
 - 3. Moisture and Mold Resistant Type - Type X with moisture and mold resistant core and surfaces. Core:
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Long Edges: Tapered.
- E. Impact Resistant Gypsum Board - ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M:
- 1. Core and Thickness: 5/8 inch (15.9 mm), Type X.
 - 2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 - 3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.

4. Soft Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 5. Hard Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements according to test in Annex A1.
 6. Long Edges: Tapered.
 7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- F. Acoustically Enhanced Gypsum Board - ASTM C1396/C1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. National Gypsum Company.
 - b. Quiet Solution.
 2. Core: 1-3/8 inch (35 mm), regular type.
 3. Long Edges: Tapered.
- G. Reinforced Gypsum Sheathing (Tile Backer Board) - ASTM C1278/C1278M, standard edges. Cellulose fiber reinforced panels may be used in lieu of cementitious board:
1. Core and Thickness: 1/2 inch (12.7 mm) or 5/8 inch (15.9 mm) to match conditions, Type X.
 2. Long Edge: Tapered.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- H. Glass Mat Gypsum Sheathing Board - ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with standard edges:
1. Core: Type X
 2. Thickness: 5/8 inch (15.9 mm).
 3. Size: 48 inches by 96 inches (1219 mm by 2438 mm).
 4. Long Edges: Tapered.
- I. Cementitious Backer Units - ASTM C1288 or ASTM C1325:
1. Thickness: 1/2 inch (12.7 mm) and 5/8 inch (15.9 mm) to match conditions.
 2. Long Edges: Standard.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- J. Exterior Gypsum Board For Ceilings and Soffits:
1. Glass Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with standard edges.
 2. Core: 5/8 inch (15.9 mm), Type X.
- K. Exterior Trim - ASTM C1047, hot dip galvanized steel sheet, plastic, or rolled zinc:
1. Shapes:
 - a. Cornerbead.
 - b. LC Bead: J shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One piece, rolled zinc with V shaped slot and removable strip covering slot opening.
- L. Interior Trim - ASTM C1047; galvanized or aluminum coated steel sheet, rolled zinc, plastic, or paper faced galvanized steel sheet:
1. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC Bead: J shaped; exposed long flange receives joint compound.
 - d. L Bead: L shaped; exposed long flange receives joint compound.
 - e. U Bead: J shaped; exposed short flange does not receive joint compound.

- f. Expansion (control) joint.
 - 2. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Pittcon Industries.
 - b. Fry Reglet Corp.
 - c. Gordon, Inc.
- M. Continuous Corner - Extruded Aluminum; continuous integral fin for surface contact with gypsum board; 7/8-inch (22 mm) wide, tapered to edge; punched with holes staggered to accept screw fastening. Prime with corrosion resistant primer. Provide Pittcon Softforms (Basis of Design) or Schluter:
 - 1. Subject to compliance with requirements, provide basis of design or comparable by one of the following:
 - a. Pittcon Industries.
 - b. Fry Reglet Corporation.
 - c. Schluter.
- N. Joint Treatment - ASTM C475/C475M:
 - 1. Joint Tape:
 - a. Exterior Gypsum Soffit Board: Paper.
 - b. Joint Compound for Exterior Applications, Glass Mat Gypsum Sheathing Board: Recommended by sheathing board manufacturer.
 - c. Joint Tape, Interior Gypsum Board: Paper.
 - 2. Joint Compound:
 - a. Gypsum Board – Prefilling - At open joints, rounded or beveled panel edges, and damaged surface areas, use setting type taping compound:
 - 1) Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting type taping compound:
 - a) Use setting type compound for installing paper faced metal trim accessories.
 - 2) Fill Coat: For second coat, use setting type, sandable topping compound.
 - 3) Finish Coat: For third coat, use setting type, sandable topping compound.
 - 4) Skim Coat: For final coat of Level 5 finish, use setting type, sandable topping compound.
 - b. Cementitious Units: Recommended by backer unit manufacturer.
 - c. Tile Backing Panels: Recommended by backer unit manufacturer.
 - d. Water Resistant Gypsum Backing Board: Use setting type taping compound and setting-type, sandable topping compound.
 - e. Joint Compound, Glass Mat Sheathing Board: Recommended by sheathing board manufacturer.
- O. Auxiliary Gypsum Materials - Comply with referenced installation standards and manufacturer's written recommendations:
 - 1. Steel Drill Screws: ASTM C1002, use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112-inch (0.84 to 2.84 mm) thick.
 - 2. Sound Attenuation Blankets - ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool:
 - a. Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 3. Acoustical Sealant - Nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
 - a. Manufacturers are subject to compliance with requirements; provide products by

one of the following:

- 1) Hilti, Inc.
- 2) Pecora Corporation.
- 3) Specified Technologies, Inc.
- 4) United States Gypsum Company.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations:
 1. Comply with ASTM C840 for gypsum board manufacturer's written instructions, whichever are more stringent:
 - a. Do not install paper faced gypsum panels until installation areas are enclosed and conditioned.
- B. Room Temperatures: Maintain minimum 40 degrees F (4 degrees C). For adhesive attachment and finishing of gypsum board, maintain minimum 50 degrees F (10 degrees C) for 48 hours before application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.
- C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.
- D. Do not install panels that are wet, moisture damaged, and mold damaged:
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.2 EXAMINATION

- A. Examine areas and substrates including welded hollow metal frames, cast in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.4 INSTALLATION

- A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
- B. Gypsum Board Assemblies: Comply with requirements in ASTM C840 applicable to framing installation.
- C. Framing Assembly:
 1. Where studs are installed directly against exterior masonry walls or dissimilar metals at

exterior walls, install isolation strip between studs and exterior wall:

- a. Install studs so flanges within framing system point in same direction. Space studs in single layer application as indicated on drawings.
 - b. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling:
 - 1) Door Openings - Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs:
 - a) Install two studs at each jamb, unless otherwise indicated.
 - b) Install cripple studs at head adjacent to each jamb stud, with minimum 1/2-inch (12.7mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 2) Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - c. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.
- D. Sound Insulation: Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- E. Gypsum Panels:
1. Comply with ASTM C840. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged:
 - a. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
 - b. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
 - c. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
 - d. Form control and expansion joints with space between edges of adjoining gypsum panels.
 - e. Cover both faces of support framing with gypsum panels in concealed spaces, except in chases braced internally:
 - 1) Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2) Fit gypsum panels around ducts, pipes, and conduits.
 - 3) Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4-inch to 3/8-inch (6.4 mm to 9.5 mm) wide joints to install sealant.
 - f. Isolate perimeter of gypsum board applied to nonload bearing partitions at structural abutments, except floors. Provide 1/4-inch to 1/2-inch (6.4mm to 12.7mm) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural

surfaces with acoustical sealant.

- g. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Gypsum Board:

- 1. Install interior gypsum board where indicated on drawings:
 - a. Single Layer Application:
 - 1) On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2) On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and minimize end joints. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 3) Fastening Methods: Apply gypsum panels to supports with steel drill screws.
 - 2. Multilayer Application:
 - a. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - b. On Z shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - c. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
 - 3. Fire Rated Patch and Repair Assemblies:
 - a. On partitions/walls, of fire rated assemblies apply patch and repair gypsum board indicated to meet rated requirements (Per 2022 CBC).
 - b. Use as a guideline for each assembly Gypsum Association "Fire-Resistant Assemblies" and recommendations.
 - 1) "Repair of Fire-Rated Gypsum Panel Product Systems – GA-225-15" minimum 2015 Edition.

G. Backing Panels:

- 1. Cementitious Backer Units: ANSI A108.11; install where indicated with 1/4-inch (6.4 mm) gap where panels abut other construction or penetrations. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

H. Exterior Gypsum Board Soffits:

- 1. Apply panels perpendicular to supports, with end joints staggered and located over supports:
 - a. Install with 1/4-inch (6.4 mm) open space where panels abut other construction or structural penetrations.
 - b. Fasten with corrosion-resistant screws.

I. Trim Accessories:

- 1. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Attach trim according to manufacturer's written instructions:
 - a. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
 - b. Exterior Trim:
 - 1) Install in the following locations:

- a) Cornerbead: Use at outside corners.
 - b) LC Bead: Use at exposed panel edges.
 - c. Interior Trim:
 - 1) Install in the following locations:
 - a) Cornerbead: Use at outside corners, unless otherwise indicated.
 - b) Bullnose Bead: Use at outside corners.
 - c) LC Bead: Use at exposed panel edges.
 - d) L Bead: Use where indicated or necessary.
 - e) U Bead: Use at exposed panel edges.
- J. Gypsum Board Finishing:
 - 1. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces:
 - a. Prefill open joints, rounded or beveled edges, and damaged surface areas.
 - b. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
 - c. Gypsum Board Finish Levels:
 - 1) Finish panels to levels indicated below and according to ASTM C840:
 - a) Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - b) Level 2: Panels that are substrate for tile.
 - c) Level 3: Surfaces be coated with drywall primer prior to final finishes. Heavy or medium texture finishes before final painting, or where heavy-grade wall coverings are to be applied as the final decoration. This level of finish is not recommended where smooth painted surfaces, or light to medium weight wall coverings as specified.
 - d) Level 4: For surfaces receiving wall covering and flat paints.
 - e) Level 5: For surfaces receiving gloss or semigloss paint and surfaces subjected to severe lighting. To be used in Kitchen areas and food service areas only.
 - d. Glass Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
 - e. Glass Mat Faced Panels: Finish according to manufacturer's written instructions.
- K. Installation Tolerances:
 - 1. Suspension System: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
 - 2. Installation Tolerances, Suspension System: Install suspension systems level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 PROTECTION

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

END OF SECTION 09 21 16

SECTION 09 24 00
CEMENT PLASTERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Exterior plasterwork (stucco).
 - 2. Metal framing and accessories.
 - 3. Metal lath and furring.
 - 4. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 05 50 00: Metal Fabrications.
 - 2. Section 06 10 00: Rough Carpentry.
 - 3. Section 07 92 00: Joint Sealants.
 - 4. Section 07 95 00: Expansion Control.
 - 5. Section 09 21 16: Gypsum Board Assemblies.
 - 6. Section 09 91 23: Painting.

1.3 SUBMITTALS

- A. Product Data: Submit technical data for product and accessory, including construction details and material descriptions.
- B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code:
 - a. Comply with applicable provisions of the CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 1) CBC 2022, 2507.3 Attachment requirements.
 - 2. Fire Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.
- B. Pre-installation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cementitious materials in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.
- B. Store materials inside under cover and keep them dry and protected against damage from

weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide products of one of the following:
 - 1. Metal Lath and Accessories:
 - a. Alabama Metal Industries.
 - b. CEMCO.
 - c. ClarkDietrich Building Systems.
 - d. Marino/WARE.
 - e. Phillips Manufacturing.
 - 2. Wire Fabric Lath:
 - a. Davis Wire.
 - b. Jaenson Wire Company.
 - c. Keystone Steel and Wire Co.
 - d. K-Lath.
 - 3. Plastic Accessories:
 - a. Alabama Metal Industries.
 - b. Phillips manufacturing.
 - c. Plastic Components.
 - d. Vinyl Corp.
 - 4. Ready Mixed Finish Coat Plaster:
 - a. Omega Products International.
 - b. California Stucco Product.
 - c. El Rey Solutions.
 - d. Florida Stucco.
 - e. Quikrete.
 - f. Shamrock Stucco.
 - 5. Acrylic Based Finish Coat:
 - a. California Stucco Product.
 - b. Dryvit Systems.
 - c. El Rey Solutions.
 - d. Finestone, BASF Corp.
 - e. Omega Products International.
 - f. Senergy, BASF Corp.
 - g. Sto Corp.
- B. Cold Formed Steel Framing: Refer to Sections 05 50 00 for steel Fabrications and 09 21 16 for Gypsum Board Assemblies framing for exterior plaster.
- C. Steel Studs and Runners: Refer to Section 09 21 16 for steel partition framing for interior plaster.
- D. Soffit Framing: Refer to Sections 06 10 00 and 09 21 16.
- E. Metal Lath:
 - 1. Expanded Metal Lath:
 - a. ASTM C847, cold rolled carbon steel sheet with ASTM A653/A653M, G60 (Z180), hot dip galvanized zinc coating:
 - 1) Diamond Mesh Lath: Self furring, 3.4 lb/sq. yd. (1.8 kg/sq. m).

- 2) Comply with DSA IR 25-4 for the installation of Self-Furring Metal Lath.
 2. Paper Backing:
 - a. FS UU-B-790a, Type I, Grade D, Style 1a vapor retardant paper:
 - 1) Provide two-layer wood sheathing paper backed lath at exterior locations.
 3. Building Wrap:
 - a. Spun-bounded high density polyethylene fibers. No binders or fillers. As manufactured by: Dupont Tyvek Commercial Type D Building Wrap or approved equal. Install per manufacturer's instructions (Installation to meet CBC 2510.6).
- F. Accessories:
1. Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required:
 - a. Metal Accessories:
 - 1) Foundation Weep Screed: Fabricated from hot dip galvanized steel sheet, ASTM A653/A653M, G60 (Z180) zinc coating.
 - 2) Cornerite: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot dip galvanized-zinc coating.
 - 3) Outside Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot dip galvanized zinc coating.
 - 4) Cornerbeads - Fabricated from zinc or zinc coated (galvanized) steel:
 - a) Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
 - b) Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
 - 5) Casing Beads: Fabricated from zinc or zinc coated (galvanized) steel; square edged style; with expanded flanges.
 - 6) Control Joints: Fabricated from zinc or zinc coated (galvanized) steel; one piece type, folded pair of unperforated screeds in M shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - 7) Expansion Joints: Fabricated from zinc or zinc coated (galvanized) steel; folded pair of unperforated screeds in M shaped configuration; with expanded flanges.
 - 8) Two Piece Expansion Joints: Fabricated from zinc or zinc coated (galvanized) steel; formed to produce slip joint and square edged reveal adjustable from 1/4 to 5/8-inch (6 to 16 mm) wide; with perforated flanges.
 - b. Plastic Accessories - Manufactured from high impact PVC:
 - 1) Cornerbeads - With perforated flanges:
 - a) Smallnose cornerbead; use unless otherwise indicated.
 - b) Bullnose cornerbead, radius 3/4 inch (19 mm) minimum; use at locations indicated on Drawings.
 - 2) Casing Beads - With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated:
 - a) Square edge style, unless otherwise indicated.
 - b) Bullnose style, radius 3/4 inch (19 mm) minimum; use at locations indicated on Drawings.
 - 3) Control Joints: One piece type, folded pair of unperforated screeds in M shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - 4) Expansion Joints: Two piece type, formed to produce slip joint and square edged 1/2 inch (13 mm) wide reveal; with perforated concealed flanges, unless otherwise detailed or noted in Section 07 95 00: Expansion Control.
 - c. Aluminum Reveals and Moldings, where applicable:
 - 1) Manufacturer: Fry Reglet
 - 2) Width: 2 inch

- 3) Material: Extruded 6063 T5 Aluminum
 - 4) Finish: Kynar - Silver Satin.
 - 5) Provide all required accessories, moldings, and prefabricated intersection/corner transition pieces for a complete installation.
 - d. Aluminum Soffit Vents:
 - 1) Manufacturer: Fry Reglet
 - 2) Width: 3 inch
 - 3) Material: Extruded 6063 T5 Aluminum
 - 4) Finish: Kynar - Silver Satin
 - 5) Provide all required accessories, moldings, and prefabricated intersection/corner transition pieces for a complete installation.
- G. Miscellaneous Materials:
1. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
 2. Fiber for Base Coat: Alkaline resistant glass or polypropylene fibers, 1/2-inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.
 3. Bonding Compound: ASTM C932.
 4. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.
 5. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21 mm) diameter unless otherwise indicated.
 6. Building Wrap: Spun-bounded high density polyethylene fibers. No binders or fillers. As manufactured by: Dupont Tyvek Commercial Type D Building Wrap or approved equal. Install per manufacturer's instructions.
 7. Sound Attenuation Blankets:
 - a. ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool:
 - 1) Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- H. Plaster Materials:
1. Portland Cement - ASTM C150/C150M, Type I or II:
 - a. Color for Finish Coats: Match existing.
 2. Colorants for Job Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color selected by Architect.
 3. Lime: ASTM C206, Type S; or ASTM C207, Type S.
 4. Sand Aggregate - ASTM C897:
 - a. Color for Job Mixed Finish Coats: White.
 5. Exposed Aggregates for Finish Coats: Match existing.
 6. Ready Mixed Finish Coat Plaster:
 - a. Mill mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
 - 1) Color: Selected by Architect.
 7. Acrylic Based Finish Coatings:
 - a. Factory mixed acrylic emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic based finishes:
 - 1) Color: Selected by Architect.

2.2 PLASTER MIXES

- A. Comply with ASTM C926 for applications indicated:
1. Fiber Content: Add fiber to base coat mixes after ingredients have mixed at least two

minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

- B. Base Coat Mixes for Use over Metal Lath:
 - 1. Scratch and brown coats for three coat plasterwork:
 - a. Portland Cement Mix:
 - 1) Scratch Coat: For cementitious material, mix 1-part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1-part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
- C. Job Mixed Finish Coat Mixes:
 - 1. Portland Cement Mix: For cementitious materials, mix 1-part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
- D. Factory Prepared Finish Coat Mixes: For ready mixed finish coat plasters or acrylic based finish coatings, comply with manufacturer's written instructions.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Comply with applicable requirements of ASTM C926.
- B. Environmental Requirements: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.
- C. Cold Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.
- D. Warm Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.
- E. Ventilation: Provide natural or mechanical means of ventilation to properly dry interior spaces after portland cement plaster has cured.
- F. Exterior Plasterwork:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient temperature is greater than 40 degrees F (4.4 degrees C).
 - 3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
- G. Protect contiguous Work from soiling and moisture deterioration caused by plastering.

Provide temporary covering and take precautions necessary to minimize spattering of plaster on adjacent Work.

- H. Factory Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

3.2 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

- A. Protect adjacent Work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare smooth, solid substrates for plaster according to ASTM C926.

3.4 INSTALLATION

- A. Metal Lath:
 - 1. Install according to ASTM C1063:
 - a. Partition Framing and Vertical Furring: Flat diamond mesh lath.
 - b. Horizontal Framing: Flat diamond mesh lath.
- B. Accessories:
 - 1. Install according to ASTM C1063 and at locations indicated on Drawings:
 - a. Reinforcement for External (Outside) Corners:
 - 1) Install [lath type, external corner reinforcement] [cornerbead] at exterior locations.
 - 2) Install cornerbead at interior locations.
 - b. Control Joints - Locate as approved by Architect for visual effect:
 - 1) As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
 - b) Horizontal and Other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
 - 2) At distances between control joints of not greater than 18 feet (5.5 m) o.c.
 - 3) As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - 4) Where control joints occur in surface of construction directly behind plaster.
 - 5) Where plasterwork areas change dimensions, to delineate rectangular shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.5 PLASTER APPLICATION

- A. Comply with ASTM C926:
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
 - 2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster

- sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces ready to receive field applied finishes indicated.
- B. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet (3 mm in 3 m) from a true plane in finished plaster surfaces, measured by a 10 foot (3m) straightedge placed at any location on surface.
- C. Walls; Base Coat Mixes for Use over Metal Lath:
1. For scratch and brown coats, for three coat plasterwork with 3/4 inch (19 mm) total thickness:
 - a. Portland cement mixes.
- D. Plaster Finish Coats: Apply to provide dash finish.
- E. Acrylic Based Finish Coatings (Contractor Option to Plaster Finish Coat): Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.
- F. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

3.6 PLASTER REPAIRS

- A. Repair or replace Work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.
- B. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other Work. Repair cracks and indented surfaces. Point up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace Work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.7 TOLERANCES

- A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet (3mm in 3 m).
- B. Maximum Variation from True Position: 1/8 inch (3mm).

3.8 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of Work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.
- B. Remove unused materials, containers, equipment, and plaster debris.
- C. Protect plaster and maintain conditions ensuring finished plaster is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 24 00

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Texture finishes.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Textured Finishes: for each textured finish indicated and on same backing indicated for Work.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies:** For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies:** For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Low Emitting Materials:** For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying 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."

2.02 GYPSUM BOARD

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. American Gypsum.
2. CertainTeed Corp.

3. Georgia-Pacific Gypsum LLC.
 4. USG Corporation.
 5. Pabco Gypsum
 6. DragonBoard US
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered
 3. To be used at most walls.
- C. SilentFX Noise-Reducing Gypsum Board by CertainTeed ASTM C 1396/C 1629
1. Thickness: 5/8 inch
 2. Long Edges: Tapered
 3. To be used at common wall sections where any of the following rooms are adjacent to each other:
- D. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered
 3. At all 1-hour or 45 minute assemblies.
- At contractor's option:
Moisture, Mold and Abuse resistant gyp board, Type X (ASTM C 473/ D 3273/ C 1629/ E 84) may be used in lieu of standard Type X gyp board at rated walls as required for sequence of construction w/o altering the UL rating. (5/8" thick w/ tapered long edges)
- E. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
1. Thickness: 1/4 inch.
 2. Long Edges: Tapered.
 3. (2) layers at curved non-rated walls.
- F. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
 3. At ceiling locations
- G. Moisture Resistant Sheathing Board: ASTM E 119 (dragon board or equal).
1. Thickness: 9/16 inch as required for rated-assembly indicated on dwgs.
 2. Long Edges: Tapered.
 3. At all 2-hour fire walls (UL-055)
- H. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, Level 3.

1. Core: 5/8 inch, .
 2. Long Edges: Tapered.
 3. At non-rated Gymnasium walls up to 10'
 4. Abrasion Resistance: Level 1
 5. Impact Resistance: Level 3
 6. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- I. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch, Type X at rated walls.
 2. Long Edges: Tapered.
 3. At areas prone to moisture such as food production/service areas, toilet rooms, wet areas around sinks, locker rooms, cooking classrooms,
 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- J. Gypsum Liner Panels: ASTM C 442/ C 1396/ E136/ E84.
1. Core: 1" Thick
 2. At rated ceilings & walls indicated on plans.

2.03 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
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. American Gypsum.
 - b. CertainTeed Corp.
 - c. Georgia-Pacific Gypsum LLC.
 - d. Lafarge North America Inc.
 - e. National Gypsum Company.
 - f. USG Corporation.
 - g. DragonBoard US.
 2. Core: As indicated
- B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; GlasRoc Sheathing.

- b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
- c. National Gypsum Company; Gold Bond, e(2)XP.
- d. USG Corporation; Securock Glass Mat Sheathing.

2. Core: As indicated.

2.04 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. CertainTeed Corp.; GlasRoc Tile Backer.
- b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.

2. Core: As indicated on Drawings

3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. C-Cure; C-Cure Board 990.
- b. CertainTeed Corp.; FiberCement BackerBoard.
- c. Custom Building Products; Wonderboard.
- d. James Hardie Building Products, Inc.; Hardiebacker 500.
- e. National Gypsum Company, Permabase Cement Board.
- f. USG Corporation; DUROCK Cement Board.

2. Thickness: As indicated.

3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.05 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.

C. Aluminum Trim: ASTM B 221, Alloy 6063-T5.

2.06 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.07 AUXILIARY MATERIALS

- A. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated. Provide Type W for wood studs spaced at 12" o.c. along stud. At metal studs provide #10 sms at 12" o.c. along stud.
- C. Acoustical Joint Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
- D. Thermal Insulation: As specified in Section 07 21 00 - Thermal Batt Insulation.
- E. Vapor Retarder: As specified in Section 07 21 00 - Thermal Batt Insulation.

2.08 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; ProRoc Wall and Ceiling Spray Texture.
 - b. Georgia-Pacific Gypsum LLC; ToughRock Ceiling Textures/Vermiculite.
 - c. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).
2. Texture:
 - a. General: Orange Peel
 - b. Restrooms: Orange Peel

PART 3 - EXECUTION

3.01 APPLYING AND FINISHING PANELS

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 1. Aluminum Trim: Install in locations indicated on Drawings .
 2. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- E. Prefill open joints, beveled edges, and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile, Panels that are substrate for acoustical tile and vinyl tackboard.

- 3. Level 3: Storage Closets.
- 4. Level 4: At most locations not specified
 - a. Primer and its application to surfaces are specified in Section 09 91 23 - Painting.
- 5. Level 5: Not Used.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 - Painting.
- H. Texture Finish Application: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- I. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- J. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Ceramic mosaic tile.
 - 2. Accessories required for indicated installation.
- B. Related Sections:
 - 1. Section 09 21 16: Gypsum Board Assemblies.
 - 2. Section 09 65 13.13: Resilient Base.

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction:
 - 1. Level Surfaces: Minimum 0.6.
 - 2. Ramp Surfaces: Minimum 0.8.
- B. Ceramic Tile Flooring should be stable, firm, and slip resistant, pursuant to 2022 CBC Section 11B-302.1.

1.4 SUBMITTALS

- A. Product Data: Technical data including data sheets, installation recommendation, and recommended joint widths.
- B. Shop Drawings - Show locations of each type of tile and tile pattern:
 - 1. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples - Submit samples showing full range of color and texture variations expected:
 - 1. Full size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required; minimum 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed work.
 - 3. Waterproof membrane in 6 x 6-inch sample.
- D. Test Reports: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile products with requirements for slip resistance.
- E. Maintenance Instructions: Submit maintenance instructions for each type of product specified.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code: Comply with applicable requirements for the CBC for interior finishes.
 - 2. Surface Burning Characteristics - ASTM E84; identify products with appropriate markings of applicable testing agency:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.
 - 3. Accessibility Requirements - Comply with applicable requirements:
 - a. Americans with Disabilities Act of 1990, as amended:
 - 1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
 - b. 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
 - 2) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
- B. Source Limitations for Tile: Obtain tile of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- D. Source Limitations for Other Products - Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Waterproofing.
 - 2. Joint sealants.
 - 3. Cementitious backer units.
 - 4. Metal edge strips.
- E. Mockups:
 - 1. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
 - a. Build mockup of each type of floor tile installation.
 - b. Build mockup of each type of wall tile installation.
 - c. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided. Store liquid materials in unopened containers and protected from freezing.
- C. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

PART 2 PRODUCTS

2.1 MATERIALS

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting:
 - 1. For factory mounted tile, provide back or edge mounted tile assemblies as standard with manufacturer unless otherwise indicated:
 - a. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.2 TILE PRODUCTS

- A. General: Manufacturers are subject to compliance with the following requirements.
- B. Floor Tile:
 - 1. Basis of Design Product/Manufacturer: **Crossville**.
 - 2. Type: TL-1, TL-3, TL-5, TL-7
 - 3. Module Size: Refer to Color Schedule in the Drawings.
 - 4. Thickness: Refer to Color Schedule in the Drawings.
 - 5. Surface: Matte
 - 6. Dynamic Coefficient of Friction: Not less than 0.42.
 - 7. Location: As indicated in the Drawings.
 - 8. Grout Color: Refer to Color Schedule in the Drawings.
 - 9. Tile color: Refer to Color Schedule in the Drawings.
 - 10. Installation Pattern: Straight Joint.
- C. Wall Tile:
 - 1. Basis of Design Product/Manufacturer: **Crossville**.
 - 2. Types: TL-2, TL-3, TL-6, TL-9
 - 3. Module Size: Refer to Color Schedule in the Drawings.
 - 4. Thickness: Refer to Color Schedule in the Drawings.
 - 5. Surface: Matte.
 - 6. Grout Color: Refer to Color Schedule in the Drawings.
 - 7. Tile Color: Refer to Color Schedule in the Drawings.
 - 8. Installation Pattern: Refer to Color Schedule in the Drawings.
- D. Tile Base:
 - 1. Basis of Design Product/Manufacturer: **Crossville**.
 - 2. Types: TL-4, TL-8
 - 3. Module Size: Refer to Color Schedule in the Drawings.
 - 4. Thickness: Refer to Color Schedule in the Drawings.
 - 5. Surface: Matte.

6. Base: Cove
7. Tile Color: Refer to Color Schedule in the Drawings.
8. Installation Pattern: Refer to Color Schedule in the Drawings.
9. Grout Color: Refer to Color Schedule in the Drawings.

- E. Accessories:
1. Wall to Floor Transitions Strip: Schluter-DILEX-EHK
 2. Corners and exposed edges: Schluter-RONDIC

2.3 WATERPROOF MEMBRANE

- A. Waterproof membrane complies with ANSI A118 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid Applied Membrane - Liquid latex rubber or elastomeric polymer:
1. Basis of Design - Laticrete 9235 Waterproofing Membrane. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. TEC; H.B. Fuller Construction Products Inc.
- C. Fabric Reinforced, Fluid Applied Membrane - System consisting of liquid latex rubber or elastomeric polymer and continuous fabric reinforcement:
1. Basis of Design - Laticrete 9235 Waterproofing Membrane and reinforcing Fabric. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. Merkrete by Parex USA, Inc.
- D. Latex Portland Cement Waterproof Mortar - Flexible, waterproof mortar consisting of cement based mix and latex additive:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. C-Cure.
 - b. MAPEI Corporation.
 - c. TEC; H.B. Fuller Construction Products Inc.
- E. Liquid Latex Waterproofing/Crack Isolation Membrane - Single Component, self-curing, load bearing liquid rubber polymer that forms a flexible seamless combined waterproofing membrane and crack isolation membrane compliance with ANSI A118:
1. Basis of Design - Hydroban by Laticrete International. Subject to compliance with requirements, provide basis of design or comparable product by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. TEC; H.B. Fuller Construction Products Inc.

2.4 CRACK ISOLATION MEMBRANE

- A. Crack isolation membrane complying with ANSI A118 for standard performance and recommended by manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

- B. Fabric Reinforced, Modified Bituminous Sheet - Self adhering, modified bituminous sheet with fabric reinforcement facing; 0.040-inch (1 mm) nominal thickness:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Custom Building Products.
 - b. MAPEI Corporation.
- C. Fluid Applied Membrane - Liquid latex rubber or elastomeric polymer:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.
 - d. Merkrete by Parex USA, Inc.
 - e. TEC; H.B. Fuller Construction Products Inc.
- D. Fabric Reinforced, Fluid Applied Membrane - System consisting of liquid latex rubber or elastomeric polymer and fabric reinforcement:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Bonsal American, an Oldcastle company.
 - b. Bostik, Inc.
 - c. Custom Building Products.
 - d. Laticrete International, Inc.
 - e. MAPEI Corporation.
 - f. Merkrete by Parex USA, Inc.

2.5 SETTING MATERIALS

- A. Dry Set Mortar (Thinset) - ANSI A108:
 - 1. Mortar Bed - Proportions of 1 part Portland Cement to 5 parts sand:
 - a. Portland Cement: ASTM C150, Type 1.
 - b. Sand: ASTM C144.
 - c. Water: Potable.
 - 2. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.
 - 3. Wall Applications: Provide mortar complying with requirements for nonsagging mortar in addition to requirements in ANSI A108.
- B. Modified Dry Set Mortar (Thinset) - ANSI A118:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. TEC; H.B. Fuller Construction Products Inc.
 - 2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at site.
 - 3. Wall Applications: Provide mortar complying with requirements for nonsagging mortar in addition to requirements in ANSI A118.
- C. Improved Modified Dry Set Mortar (Thinset) - ANSI A118:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. TEC; H.B. Fuller Construction Products Inc.
 2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.
 3. For wall applications, provide mortar complying with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.
- D. Modified Dry Set Mortar (Medium Bed): ANSI A118; product approved by manufacturer for application thickness of 5/8 inch (16 mm).
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.
 - c. TEC; H.B. Fuller Construction Products Inc.
 2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.
- E. Portland Cement Mortar (Thickset) Installation Materials - ANSI A108:
 1. Mortar Bed - Proportions of 1 part Portland Cement to 5 parts sand:
 - a. Portland Cement: ASTM C150, Type 1.
 - b. Sand: ASTM C144.
 - c. Water: Potable.
 2. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.
 3. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57 mm) diameter; comply with ASTM A1064, except for minimum wire size.
 4. Expanded Metal Lath - Diamond mesh lath complying with ASTM C847:
 - a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - b. Base Metal and Finish for Exterior Applications: Zinc coated (galvanized) steel sheet.
 - c. Configuration over Studs and Furring: Flat.
 - d. Configuration over Solid Surfaces: Self furring.
 - e. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).
 5. Latex Additive: Styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with field mixed portland cement and aggregate mortar bed.
- F. Tile Setting Epoxy - ANSI A118, water cleanable; 100 percent solids epoxy grout:
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
 - b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.
 2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees C and 100 degrees C), respectively, and certified by manufacturer for intended use.
 3. Color: Selected by Architect.
- G. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thinset) - ANSI A118:
 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. MAPEI Corporation.

- c. TEC; H.B. Fuller Construction Products Inc.
- 2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.

2.6 GROUT MATERIALS

- A. Water Cleanable Epoxy Grout - ANSI A118:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
 - b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.
 - c. MAPEI Corp., Kerapoxy or Kerapoxy CQ Epoxy Grout.
 - 2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees and 100 degrees C), respectively, and certified by manufacturer for intended use.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex modified, portland cement-based formulation provided or approved by manufacturer of tile setting materials for installations indicated.
- B. Vapor Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.
- C. Metal Edge Strips:
 - 1. Angle or L-shaped, height to match tile and setting bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A666, 300 Series exposed edge material.
 - a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - 1) Schluter Systems L.P.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Tile and Grout Sealer - Sealer for sealing grout joints and that does not change color or appearance of grout:
 - 1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 - a. Custom Building Products.
 - b. Summitville Tiles, Inc.
 - c. TEC; H.B. Fuller Construction Products Inc.
- F. Sealant: Silicone sealant; refer to Section 07 92 00.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum

performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
- B. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.
- C. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

3.2 EXTRA MATERIALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents:
 - 1. Tile and Trim Units: Furnish quantity of full size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

3.3 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of the work:
 - 1. Verify substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108 for installations indicated.
 - 2. Verify concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108 for installations indicated:
 - a. Verify surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced

mortar bed that complies with ANSI A108 and is sloped 1/4 inch per foot (1:50) toward drains.

- C. Blending: For tile exhibiting color variations, verify tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at site before installing.

3.5 INSTALLATION

- A. Comply with TCNA *Handbook for Ceramic, Glass, and Stone Tile Installation* for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series *Specifications for Installation of Ceramic Tile* that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used:
 - 1. For the following installations, comply with ANSI A108 series procedures for tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - d. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting bed thickness so tiles are flush.
- F. Jointing Pattern:
 - 1. Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated:
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths – Refer to Color Schedule in Drawings.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints:
 - 1. Provide expansion joints and sealant filled joints, including control, contraction, and

isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installing tiles:

- a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- K. Waterproofing:
1. Install waterproofing to comply with ANSI A108 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate:
 - a. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- L. Crack Isolation Membrane:
1. Install crack isolation membrane to comply with ANSI A108 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate:
 - a. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- M. Floor and Paver Tile and Planks - Install tile to comply with requirements in the TCNA installation methods and ANSI A108 series of tile installation standards:
1. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
 - c. Tile floors composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
 - d. Tile floors composed of rib backed tiles.
- N. Floor Tile - Install tile to comply with requirements in the TCNA installation methods and ANSI A108 series of tile installation standards:
1. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - a. Exterior tile floors.
 - b. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
 - c. Tile floors composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
 - d. Tile floors composed of rib backed tiles.
 2. Tile Installation Method:
 - a. Interior Floor Installations, Concrete Subfloor:
 - 1) TCNA F125-Full; thinset mortar on crack isolation membrane.
- O. Wall Tile Installation:
1. Install types of tile designated for wall installations to comply with requirements, including those referencing TCNA installation methods and ANSI setting bed standards:
 - a. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 - 1) Exterior tile wall installations.
 - 2) Tile wall installations in wet areas, including showers, tub enclosures,

laundries, and swimming pools.

- 3) Tile installed with chemical resistant mortars and grouts.
- 4) Tile wall installations composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
- a. Tile Installation Method, Wood or Metal Studs:
 - 1) TCNA W245; thinset mortar on glass-mat, water-resistant gypsum backer board.

3.6 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning:
 - 1. On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter:
 - a. Remove grout residue from tile as soon as possible.
 - b. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

**SECTION 09 51 00
ACOUSTICAL CEILING PANELS**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Acoustical panels.
 - 2. Concealed and exposed suspension systems for ceilings.
 - 3. Ceiling panel for food service area.
 - 4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

- A. Product Data: Technical data for each product including installation instructions.
- B. Samples:
 - 1. Acoustic Panel: Set of 6-inch (150 mm) square samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch (300 mm) long samples of each type, finish, and color.
- C. Coordination Drawings:
 - 1. 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:
 - a. Suspended ceiling components.
 - b. Structural members to which suspension systems will be attached.
 - c. Size and location of initial access modules for acoustical panels.
 - d. Items penetrating finished ceiling including but not limited to the following:
 - 1) Lighting fixtures.
 - 2) Air outlets and inlets.
 - 3) Speakers.
 - 4) Sprinklers.
 - 5) Access panels.
 - e. Perimeter moldings.
- D. Maintenance Data: Manufacturer data for finishes for inclusion in maintenance manuals.
- E. Submit one copy of ICC-ES Reports.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code:
 - a. Comply with applicable requirements of the CBC for interior finishes:
 - 1) DSA Interpretation of Regulations – IR 25-2 Metal Suspension Systems for Lay-in Panel Ceilings.
 - 2) CBC - 2022 California Building Code.
 - 3) Chapter 19, 2022 California Building Code.

- 4) Chapter 23, 2022 California Building Code.
 - 5) Acoustical Panel Standard: ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance:
 - a) Mounting Method for Measuring NRC: Plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E795.
 2. Surface Burning Characteristics:
 - a. Ceiling panels with surface burning characteristics complying with CBC and ASTM E1264 for Class A materials determined by testing identical products in accordance with ASTM E84:
 - 1) Flame Spread Index: 25 or less.
 - 2) Smoke Developed Index: 450 or less.
 3. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE 7.
 4. Fire Resistance Ratings: Comply with ASTM E119; testing by qualified testing agency. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL *Fire Resistance Directory* or from the listings of another qualified testing agency.
- B. Source Limitations:
1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Comply with applicable regulations regarding toxic and hazardous materials:
1. Coating Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment; and showing no mold or mildew growth when tested in accordance with ASTM D3273.
 2. Panel Based Antimicrobial Treatment: Provide acoustical panels manufactured with antimicrobial treatment in the panels.
- D. Pre-installation Conference: Conduct conference at site.

1.5 WARRANTY

- A. Standard Ceiling Panels: Warrant ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of one (1) year from the date of Substantial Completion.
- B. Sag Resistant Ceiling Panels: warrant products to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of ten (10) years from the date of Substantial Completion.
- C. Standard Suspension System: Suspension systems shall be warranted to be free from defects in material or factory workmanship and shall not incur 50 percent red rust as defined by ASTM B117 test procedures for a period of ten (10) years from the date of Substantial Completion.
- D. Suspension system / ceiling panels: Provide manufacturers standard 15-year warranty for suspension systems when used in combination with same manufacturers sag resistant ceiling panels. Ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects. Suspension systems shall not incur 50 percent red rust as defined by ASTM B117 test during the period of the warranty, extra materials.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to site in original, unopened packages and store in a fully enclosed, conditioned space protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, allow panels to attain room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers are subject to compliance with requirements; provide ceiling panels and grid systems by one of the following:
 - 1. Acoustical Ceiling Panel System:
 - a. Armstrong World Industries, Inc. (Basis of Design), or approved equivalent.
 - 2. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - 3. Acoustical Sealant for Concealed Joints:
 - a. Pecora Corporation; AIS-919.
- B. Acoustical Panel Colors and Patterns:
 - 1. Match appearance characteristics indicated for each product type:
 - a. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E1264 and not manufacturers' proprietary product designations, provide products selected by Architect that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 METAL SUSPENSION SYSTEM

- A. Metal Suspension System:
 - 1. Direct hung metal suspension systems of types, structural classifications, and finishes indicated complying with applicable requirements in ASTM C635/C635M:
 - a. High Humidity Finish:
 - 1) Comply with ASTM C635/C635M requirements for Coating Classification for Severe Environment Performance where high humidity finishes are indicated.
 - b. Attachment Devices - Size for five times the design load indicated in ASTM C635/C635M, Table 1 Direct Hung, unless otherwise indicated. Comply with seismic design requirements:
 - 1) Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488 or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency:
 - a) Type: Cast in place, post installed expansion or post installed bonded anchors.
 - b) Corrosion Protection: Carbon steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

- c) Corrosion Protection: Stainless steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - d) Corrosion Protection: Components fabricated from nickel copper alloy rods complying with ASTM B164 for UNS No. N04400 alloy.
 - 2) Power Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.
 - 2. Hanger Wires, Braces, and Ties:
 - a. Zinc Coated, Carbon Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 - b. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
 - c. Nickel Copper Alloy Wire: ASTM B164, nickel copper alloy UNS No. N04400.
 - d. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635/C635M, Table 1 Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 inch (2.69 mm) diameter wire.
 - 3. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust inhibitive paint.
 - 4. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04 inch (1 mm) thick, galvanized steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16 inch (8 mm) diameter bolts.
 - 5. Hold Down Clips: Provide hold down clips spaced 24 inches (610 mm) o.c. on all cross tees in areas with exterior opening larger than 48" x 96".
 - 6. Impact Clips: Provide impact clip system designed to absorb impact forces against acoustical panels in Gymnasiums.
 - 7. Aluminum cap for use over steel grid in kitchen areas or where shown on drawings or required.
 - 8. Fasteners at Steel Framing and Metal Deck:
 - 1) Steel Framing:
 - a) Shot-in Anchors.
 - 2) Metal Deck or Metal Deck without Structural Concrete:
 - a) Self-tapping Screws.
 - 3) Metal Deck or Metal Deck with Structural Concrete or Concrete:
 - a) Shot-in Anchors (hanger wire only).
 - Drilled-in Anchors.
- B. Metal Suspension Systems:
 - 1. Wide Face, Steel Capped, Double Web, Steel Suspension System:
 - a. Main and cross runners roll formed from cold rolled steel sheet; prepainted, electrolytically zinc coated, or hot dip galvanized according to ASTM A653/A653M, not less than G30 (Z90) coating designation; with prefinished 15/16 inch (24 mm) wide metal caps on flanges:
 - 1) Structural Classification: Heavy duty system.
 - 2) Face Design: Flat, flush.
 - 3) Cap Finish: Color selected by Architect.
 - 2. Narrow Face, Steel Capped, Double Web, Steel Suspension System:
 - a. Main and cross runners roll formed from cold rolled steel sheet; prepainted, electrolytically zinc coated, or hot dip galvanized according to ASTM A653/A653M, not less than G30 (Z90) coating designation; with prefinished, cold rolled, 9/16 inch (15 mm) wide metal caps on flanges:
 - 1) Structural Classification: Intermediate-duty system.
 - 2) Face Design: Flat, flush.

3) Cap Finish: Color selected by Architect.

2.3 ACOUSTICAL PANELS

- A. Acoustic Panel Type I, ACT-1:
1. Basis of Design Product: **Fine Fissured No. 1755 by Armstrong World Industries.**
 2. Classification - Provide panels complying with ASTM E1264 for type, form, and pattern:
 - a. Type and Form: Type A, mineral fiber; Form A1.2, Pattern: D
 3. Color: White.
 4. LR: Not less than 0.85.
 5. NRC: Not less than 0.75.
 6. CAC: Not less than **35**.
 7. Edge/Joint Detail: 15/16" Square Lay in.
 8. Thickness: 7/8 inch .
 9. Modular Size: 24 by 48 inches (610 by 1220 mm).
 10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.
 11. Typical Location: Primary learning areas and classrooms.
- B. Acoustic Panel Type II, ACT-2:
1. Basis of Design Product: **Fine Fissured No. 1754 by Armstrong World Industries.**
 2. Classification - Provide panels complying with ASTM E1264 for type, form, and pattern:
 - b. Type and Form: Type A, mineral fiber; Form A1.2, Pattern: D
 3. Color: White.
 4. LR: Not less than 0.85.
 5. NRC: Not less than 0.75.
 6. CAC: Not less than **35**.
 7. Edge/Joint Detail: 15/16" Square Lay in.
 8. Thickness: 7/8 inch .
 9. Modular Size: 24 by 24 inches (610 by 610 mm).
 10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21
- C. Acoustic Panel Type III, ACT-3:
1. Basis of Design Product: **Kitchen Zone No. 672 by Armstrong World Industries.**
 2. Classification - Provide fire resistance rated panels complying with ASTM E1264 for type, form, and pattern:
 - a. Type and Form: Type A, Form A2.2, mineral fiber.
 - b. Pattern: G.
 - c. Color: White.
 3. LR: Not less than 0.89.
 4. CAC: Not less than 33.
 5. Edge/Joint Detail: Square Lay In.
 6. Thickness: 5/8 inch (15 mm).
 7. Modular Size: 24 by 48 inches (610 by 1220 mm).
 8. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.

9. Typical Location: Food preparation areas, refer to Drawings.
10. Typical Location: Food preparation areas, refer to Drawings.

2.4 MOLDING, TRIM AND ACCESSORIES

- A. Shadow Molding: Where an acoustical lay in ceiling abuts a gypsum board ceiling in the same plane, provide a "W" shaped reveal or "shadow" molding similar to Armstrong Shadow Molding No. 7873.
- B. Light Fixture Protection:
 1. Manufacturer: Thermafiber Light Protection Kit by Owens Corning or Type 5/8 or 3/4 P(S) by Armstrong World Industries.
 2. Fire Resistance Rating: Same as ceiling assembly rating.
 3. Locations: At fixtures reinstalled in fire rated ceiling assemblies.
- C. Roll Formed, Sheet Metal Edge Moldings and Trim:
 1. Type and profile for standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color used for exposed flanges of suspension system runners:
 - a. Provide edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
 - b. For lay in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - c. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- D. Extruded Aluminum Edge Moldings and Trim:
 1. Where indicated, provide extruded aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 - a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B221 for Alloy and Temper 6063-T5.
 - b. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
 - c. Baked Enamel or Powder Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- E. Acoustical Sealant:
 1. Comply with ASTM C834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
 - a. Exposed and Concealed Joints: Non-sag, paintable, non-staining latex sealant.
 - b. Concealed Joints: Nondrying, nonhardening, non-skinning, non-staining, gunnable, synthetic rubber sealant.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations:

1. Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use:
 - a. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

3.2 EXTRA MATERIALS

- A. Furnish extra materials matching products installed and packaged with protective covering for storage and identified with labels describing contents:
 1. Acoustical Ceiling Panels: Full size panels equal to 2 percent of quantity installed.
 2. Suspension System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 3. Hold Down Clips: Equal to 2 percent of quantity installed.
 4. Impact Clips: Equal to 2 percent of quantity installed.

3.3 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut for compliance with requirements specified that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less than half width panels at borders and comply with layout shown on reflected ceiling plans.

3.5 INSTALLATION

- A. Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and *CISCA Ceiling Systems Handbook*:
 1. Fire Rated Assembly: Install fire-rated ceiling systems according to tested fire rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay Wire where required and, if permitted with fire resistance rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure Hanger Wire to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect Hanger Wire directly either to structures or to

- inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast in place hanger inserts, post installed mechanical or adhesive anchors, or power actuated fasteners that extend through forms into concrete and Steel Decking.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure Splay Wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for Wire Hangers, and Splay Wires. Fasten bracing wires into Concrete filled Steel Decking with cast in place or post installed anchors.
- D. Panel Accessibility: Install panels downward accessible by disengaging hinge support rail on one side of panel from the T Bar Flange or optional A Mount rail flange without the use of tools, for access without removal of panel from the ceiling.
- E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels:
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit:
1. Arrange directionally patterned acoustical panels with pattern running in one direction parallel to long axis of space.
 2. For square edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 3. For reveal edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. For reveal edged panels on suspension system members with box shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical

- panel manufacturer.
6. Install hold-down clips in areas indicated, in areas with exterior opening larger than 48" x 96", where required by authorities having jurisdiction, and for fire resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
 7. Install clean room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
 8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire resistance rated assembly.

3.6 FIRE RATING SCHEDULE

- A. Refer to UL Assemblies Drawings for Fire Rating requirements of ceiling materials at rated floor and roof assemblies.

3.7 FIELD QUALITY CONTROL

- A. Special Inspections:
 1. Engage a qualified special inspector to perform the following special inspections:
 - a. Compliance of seismic design.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements:
 1. Extent of Each Test Area:
 - a. When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed:
 - 1) Within each test area, testing agency will select one of every 10 power-actuated fasteners and post installed anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two post installed anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.8 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 00

**SECTION 09 65 13.13
RESILIENT BASE**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Rubber base.
 - 2. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. Section 09 21 16: Gypsum Board Assemblies.
 - 2. Section 09 68 00: Carpeting.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of product including manufacturer's installation instructions.
- B. Samples: Two (2) Samples of Base Selected.
- C. Maintenance Data: Submit for inclusion in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Entity having minimum 5 years documented experience who employs workers competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store base and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Product by: **Burke Mercer Flooring Products** or Architect approved equivalent.
- B. Rubber Base - ASTM F1861:
 - 1. Material: Rubber, vulcanized, Type TS, Group I, Styles A and B.
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Style: Topset cove; minimum 100 foot coil, cut to length required.
 - 4. Minimum Thickness: 0.125 inch (3.2 mm).
 - 5. Color: To be Selected by Architect.

6. Height: As indicated in the drawings, if not shown: 4"
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.
9. 4' long lengths, not rolled goods.

- C. Adhesives: Acrylic adhesive as recommended by manufacturer.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Ensure the substrate meets the requirements of ASTM F710.
- B. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).

3.2 EXAMINATION

- A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the work:
1. Verify that finishes of substrates comply with tolerances and other requirements specified for other work and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.3 PREPARATION

- A. Immediately before installation, sweep clean substrates to be covered by resilient base.

3.4 INSTALLATION

- A. Resilient Base:
1. Comply with manufacturer's written instructions for installing resilient base. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required:

I. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

Do not stretch resilient base during installation.

On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

Preformed Corners: Install preformed corners before installing straight pieces.

Job Formed Corners:

- 1) Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
- 2) Form without producing discoloration (whitening) at bends.
- 3) Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length:
 - a) Miter or cope corners to minimize open joints.

END OF SECTION 09 65 13.13

SECTION 09 65 66

RESILIENT ATHLETIC SURFACING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Resilient Flooring, including recycled rubber flooring.
 - 1. Types: Types of recycled rubber resilient flooring include:
 - a. Recycled rubber resilient floor tile.
 - b. Recycled rubber resilient roll/sheet flooring.
 - 2. Adhesives
- B. Related Sections: Section(s) related to this section include:
 - 1. Concrete Substrate: Division 03 Concrete Section(s).

1.02 REFERENCES

- A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 2. ASTM C518 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 3. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
 - 4. ASTM D2047 Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.
 - 5. ASTM E413 Classification for Rating Sound Insulation.
 - 6. ASTM E492 Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
 - 7. ASTM F137 Test Method for Flexibility of Resilient Flooring Materials.
 - 8. ASTM F710 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
 - 9. ASTM F925 Test Method for Resistance to Chemicals of Resilient Flooring.

10. ASTM F970 Test Method for Static Load Limit.
11. ASTM F2772 Standard Specification for Athletic Performance Properties of Indoor Sports Floors Systems.
12. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
13. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide recycled rubber resilient flooring, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1.04 SUBMITTALS

- A. General: Submit listed submittals in accordance with Spec Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit product data, including manufacturer's guide specifications product sheet, for specified products.
- C. Quality Assurance Submittals: Submit the following:
 1. Certificates: If required, certification of performance characteristics specified in this document shall be provided by the manufacturer.
 2. Manufacturer's Instructions: Manufacturer's installation instructions.
- D. Closeout Submittals: Submit the following:
 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Section 01 77 00 - Closeout Procedures (Maintenance Data and Operational Data). Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
 2. Warranty: Warranty documents specified herein.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 2. Manufacturer's Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.
- B. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's instructions, and manufacturer's warranty requirements.

- C. Pre-installation Testing: Conduct pre-installation testing as follows: Specify substrate testing; consult with flooring manufacturer.

1.06 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Section 01 60 00 - Product Requirements.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.

1.07 PROJECT CONDITIONS

- A. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.
- B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

- A. Project Warranty: One (1) year from final completion.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1.09 MAINTENANCE

- A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 77 00 - Closeout Procedures (Maintenance Materials).

PART 2 - PRODUCTS

2.01 RECYCLED RUBBER FLOORING

- A. Specification based on: Manufacturer: ECORE International TM. Substitutions shall be considered per Spec Section 01 25 00 – Substitution Procedures.

1. Contact: P.O. Box 989, Lancaster, PA 17608-0989 (715 Fountain Ave., Lancaster, PA 17601); Telephone: (888) 383-7655, (717) 295-3400; Fax: (717) 295-3414.
- B. EVERLAST sports surfacing with Nike Grind, manufactured by ECORE, for fitness and sports surfacing.
 1. EVERLAST sports surfacing with Nike Grind - recycled rubber resilient sheet flooring.
 2. E-Grip III™ one-component polyurethane adhesive.
- C. EVERLAST sports surfacing with Nike Grind:
 1. Roll Dimension 48" x 8 mm standard
 - a. Roll Weight 1.72 lb/ft² (8.39 kg/m²)
 - b. Roll Length: See drawings.
 - c. Standard Tolerances
 - 1) Roll Width +3/4" -0"
 - 2) Roll Length +1% -0"
 - 3) Thickness +.3 mm -.3 mm
 2. Colors: [Specify color from manufacturer's standard color selection.]
 3. Product Testing:
 - a. Tensile Strength, lb/in² (ASTM D412): 200 min.
 - b. Flexibility, 1/4-inch mandrel (ASTM F137): pass.
 - c. Static Load, 1000 lb/in² (ASTM F970): less than 0.020 in.
 - d. Coefficient of Friction (ASTM 2047): greater than 0.9.
 - e. Chemical Resistance (ASTM F925):
 - 1) 5% Acetic Acid: No Change
 - 2) 70% Isopropyl Alcohol: No Change
 - 3) 5% Sodium Hydroxide: No Change
 - 4) 5% Hydrochloric Acid: No Change
 - 5) 5% Ammonia: No Change
 - 6) Bleach: No Change
 - 7) 5% Phenol: No Change
 - 8) Sulfuric Acid: No Change
 - f. Ambient Noise Reduction, Sabin/ft² (ASTM C423): 0.10.
 - g. Thermal Conductivity, BTU-in/hr-ft²-°F (ASTM C518): approximately 0.406.
 - h. Impact Insulation Class (ASTM E492): 45 minimum.
 - i. Sound Transmission Coefficient (ASTM 413): 45 minimum.
 - j. Force Reduction (ASTM F2569 / EN14808): Class 1
 - k. Ball Rebound (EN 12235): Pass
- D. E-Grip III one-component polyurethane adhesive

1. Product Name: The one-part urethane adhesive under this specification shall be ECORE's E-Grip III one-component polyurethane adhesive.
2. Material: E-Grip III is a one-component polyurethane moisture cured, non-sag, permanently elastic adhesive that has excellent adhesion to elastomers, concrete, and wood and is engineered for indoor and outdoor applications.
3. Adhesive Type: one-component polyurethane.
4. Adhesive Cure System: moisture cured.
5. Weight: 4 gallon pail - 56 lbs.
6. VOC Content: 0 (calculated).
7. Solvents: None
8. Freeze/Thaw: Stable
9. Application Temperature: 40°F to 100°F.
10. Calcium Chloride Test (ASTM F1869): Maximum 5.5 lbs per 1,000 sq. ft. in 24 hrs allowable.
11. Relative Humidity (RH) Test (ASTM F2170): Maximum 85% RH allowable.
12. Flashpoint: > 500° F.
13. Shelf Life: 12 months.
14. Working Time: 30-40 minutes.
15. Trowel: 1/16" square notched trowel (1).
16. Coverage Rate: 95 ft² per gallon (1/16" square notched trowel).
17. SCAQMD Rule #1168: 0 (calculated).

- E. For indoor installation on concrete or plywood subfloors only. See EVERLAST Installation Manual for instructions.

2.02 RELATED MATERIALS

- A. Related Materials: Refer to other sections listed in Related Sections paragraph herein for related materials.

2.03 SOURCE QUALITY

- A. Source Quality: Obtain recycled rubber resilient flooring materials from a single manufacturer.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

- A. Surface Preparation: Provide Concrete Moisture Vapor Emission Control, see Spec Section 07 26 00 – Concrete Moisture Vapor Emission Control.

3.04 ERECTION / INSTALLATION / APPLICATION / CONSTRUCTION

- A. Recycled Rubber Flooring Installation: Comply with EVERLAST sports surfacing with Nike Grind Technical Manual for installation procedures and techniques for EVERLAST sports surfacing with Nike Grind - recycled rubber resilient flooring installation.
- B. Finish Color/Textures/Patterns: As selected by Architect.
- C. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

3.05 FIELD QUALITY REQUIREMENTS

- A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - 1. Site Visits: two periodic site visits.

3.06 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.07 PROTECTION

- A. Protection: Protect installed product and finished surfaces from damage during construction.

END OF SECTION

SECTION 09 67 23 RESINOUS FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. High-performance resinous flooring systems.
- B. Related Sections:
 - 1. Division 03 sections.
 - 2. Division 09 sections.
 - 3. Division 10 sections.
- C. Reference Standards
 - 1. 2022 California Building Code:
 - a. California Building Standards Administrative Code, Part 1, Title 24 CBSC.

1.3 SUBMITTALS

- A. Product Data: For each type of product include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Initial Selection: For each type of exposed finish required.
- C. Samples for Verification: Submit two 6" X 6" samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Provide sample color and texture for approval from Owner in writing prior to installation.
- D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- E. Material Certificates: For each resinous flooring component, from manufacturer.
- F. Material Test Reports: For each resinous flooring system, by a qualified testing agency.
- G. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

- A. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

- C. Flammability: Self-extinguishing according to ASTM D635.
- D. System Chemical Resistance:
 - 1. Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D1308 for 50 percent immersion for no fewer than seven (7) days.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer:
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Mockups:
 - 1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
 - a. Apply full-thickness mockups on 96-inch (2,400 mm) square floor area selected by Architect. Include 96-inch length of integral cove base with inside and outside corner.
 - b. Simulate finished lighting conditions for Architect's review of mockups.
 - c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Pre-Installation Meetings:
 - 1. Pre-installation conference: Conduct pre-job conference with representatives of Owner, Contractor, applicator and material manufacturer in attendance:
 - a. The agenda shall include a review and clarification of this specification, application procedures, quality control, inspection and acceptance criteria, and production schedules.
 - 2. Contractor is not authorized to proceed until this meeting is held or waived by Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.
 - 1. Basis of design: The Sherwin Williams Company.
 - a. "Resufloor Screed Deco Quartz."
 - 2. Alternative manufacturers subject to compliance with the design requirements.

2.2 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.
- B. System Characteristics:
 - 1. Color and pattern: As selected by Owner from manufacturers standard color.
 - 2. Wearing surface: Textured for slip resistance.
 - 3. Overall system thickness: 3/16 inch, nominal thickness.
 - 4. Federal agency approvals: USDA approved.
 - 5. Coats, as recommended by manufacturer:
 - a. Primer: at 250 sq. ft. per gallon.
 - a. Mortar: 70 lbs. per 1.25 gallons resin spread at 66 sq. ft. per kit.
 - b. Bonding Coat: at 100 sq. ft. per gallon.
 - c. Broadcast: Colored Quartz to excess at 0.4 lbs. per sq. ft.
 - d. Grout Coat: at 100 sq. ft. per gallon.
 - e. Seal Coat: at 200 sq. ft. per gallon. 1st Broadcast: at 0.4 lbs. per sq. ft.
- C. System Physical Properties:
 - 1. Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
 - a. Hardness at 24 hours: 80/65 Shore D as per ASTM D 2240.
 - b. Compressive strength: 15,000 psi as per ASTM C 579.
 - c. Tensile strength: 1,700 psi as per ASTM C 307.
 - d. Tensile strength: 6,000 psi as per ASTM D 638.
 - e. Flammability: Class I per ASTM E 648.
 - f. Flux Flexural Strength: 3,700 psi per ASTM C 580.
 - g. Adhesion: 300 psi per ACI 503R.
 - h. Abrasion resistance: 90 mg loss as per ASTM D 4060, CS-17 Wheel, 1,000 cycles.
 - i. Impact resistance: 16 ft/lbs as per MIL-D-3134J.

2.3 ACCESSORIES

- A. Waterproofing Membrane:
 - 1. Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated:
- B. Reinforcing Membrane:
 - 1. Flexible resin formulation that is recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from

- reflecting through resinous flooring:
a. Applied to all construction and expansion joints.

- C. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- D. Integral cove base: Six inches (6") high.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

3.2 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Concrete Substrates:
1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 2. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with manufacturer's written instructions.
 3. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 4. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions. Provide moisture vapor resistant primer when test results are above minimum requirements:
 - a. Anhydrous calcium chloride test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of three (3) pounds of water per 1,000 square feet of slab area in 24 hours.
 - b. Relative humidity test: Use in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Alkalinity and adhesion testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Patching and Filling:
1. Use patching and fill material to fill holes and depressions in substrates according to

manufacturer's written instructions:

- a. Control joint treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.3 APPLICATION

- A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated:
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 3. Expansion and isolation joint treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.
- D. Integral Cove Base:
1. Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
- E. Self-Leveling Body Coats:
1. Apply self-leveling slurry body coats in thickness indicated for flooring system.
 2. Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- F. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.
- G. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.
- H. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

3.4 FIELD QUALITY CONTROL

- A. Material Sampling:
1. Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements:
 - a. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.

- b. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 - c. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.
- B. Core Sampling: At the direction of Owner and at locations designated by Owner, take one (1) core sample per 1,000 square feet (92.9 sq. m.) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two (2) additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.5 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
- B. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

END OF SECTION

SECTION 09 68 00 CARPETING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Requirements including but not limited to:
 - 1. Carpet.
 - 2. Carpet Pad.
 - 3. Accessories necessary for a complete installation.
- B. Related Sections:
 - 1. 03 30 00: Cast-in-Place Concrete.
 - 2. 09 65 13.13: Resilient Base.
 - 3. 09 65 23: Luxury Vinyl Tile Flooring

1.3 DEFINITIONS

- A. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

Review delivery, storage, and handling procedures.

Review ambient conditions and ventilation procedures.

Review subfloor preparation procedures.

1.5 SUBMITTALS

- A. Product Data: Technical data including installation recommendations for each type of substrate:
 - 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. Samples: For each products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet: 12 inch (300 mm) square Sample from approved color and product of carpet.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.
 - 3. Carpet Seam: 6 inch (150 mm) Sample.
 - 4. Mitered Carpet Border Seam: 12 inch (300 mm) square Sample. Show carpet pattern alignment.
 - 5. Carpet base and accessory samples.

- C. Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.
- D. Shop Drawings: Showing extent of product, seam direction, and location and type of carpet accessories. Submittal to indicate columns, doorways, enclosing walls or partitions, casework, and locations where cutouts are required.
- E. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Building Code: Comply with applicable requirements for the CBC for interior finishes.
 - 2. Fire Test Response Characteristics: Provide products with the critical radiant flux classification determined by testing identical products in accordance with ASTM E 648. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
 - 3. Accessibility Requirements - Comply with applicable requirements:
Americans with Disabilities Act of 1990, as amended:
 - 1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design
 - 2) 2010 ADA regulations.
- CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
- 1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
 - 4. San Joaquin Valley Air Pollution Control District Regulations for Adhesive and Sealant Applications.
 - 5. CRI – Carpet and Rug Institute Green Label Plus.
 - 6. Carpet shall have level loop, textured loop, or level-cut/un-cut pile texture, firm cushion, pad or backing (or no cushion or pad) and maximum pile height of 1/2 inch in accordance with 2022 CBC Section 11B-302.2. Carpet edges shall comply with CBC 11B-302.2 and carpet trim to CBC Section 11B-303.
- B. Installer Qualifications: Installer having minimum 5 years documented experience as a commercial carpet installer, who is certified by the International Certified Floorcovering Installers Association at the Commercial II or higher certification level.
 - C. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.
- B. Store in a dry location between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally, elevated above slab level on a flat surface, stacked no higher than two rolls.
- C. Store materials in area of installation for minimum period of 48 hours prior to installation.
- D. Protect carpet from damage, dirt, stains, and moisture.

1.8 WARRANTY

- A. Contractor's Standard Installation Warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose product meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of ten (10) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
 2. Patcraft (basis of design), or acceptable alternative manufacturers, subject to compliance with design requirements.
Carpet Schedule: Refer to Drawings for all carpet types and locations

2.2 MATERIALS

- A. General Carpet Requirements
1. Performance:
 2. Appearance Retention Rating: Severe traffic, 3.5 minimum according to ASTM D 7330.
 3. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
 4. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
 5. Delamination: Not less than 4 lbf/in. (18 N/mm) per ASTM D 3936.
 6. Tuft Bind: Not less than 5 lbf (22 N) according to ASTM D 1335.
 7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
 8. Resistance to Insects: Comply with AATCC 24.
 9. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
 10. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
 11. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria; not less than 1 mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
 12. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
 13. Backing: Standard with manufacturer.
- B. Carpet Composition, CPT-1
1. Style: Big Splash!, I0166
 2. Construction: Pattern Loop
 3. Fiber: ecosolution q® nylon
 4. Dye Method: 80% solution dyed 20% yarn dyed
 5. Backing: Non-woven synthetic
 6. Size: 24 in x 24 in
 7. Gauge: 1/10 inches
 8. Total Thickness: 0.275 inches
 9. Tufted Weight: 26 oz/yd sq.
- C. Carpet Composition, CPT-2
1. Style: Entry Point 10306

2. Construction: Needlebond
3. Dye Method: 100% solution dyed
4. Backing: Polypropylene
5. Size: 24 in x 24 in
6. Finished Pile Thickness: 0.263 inches / 6.68 mm
7. Total Thickness: 0.348 inches / 8.84 mm
8. Tufted Weight: 44.5 oz/yd sq.

2.3 ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Use a cementitious patching/leveling compound that meets or exceeds the required moisture level and pH requirements. Use of gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the compressive strength of 3,000 psi are acceptable.
- B. Primer: is an acrylic solution made to neutralize excess alkali that is also recommend as a primer coat to prevent over absorption of adhesive and to ensure a better bond. Formulated with an antimicrobial agent, it provides protection against bacteria, fungi, and mildew in the wet or dry state. Contains no solvent, alcohol, or other hazardous materials per OSHA 29 CFR 1910.1200. Non-photo chemically reactive per rule #102. Available in 4-gallon pails.
- C. High Moisture Management Solutions (10 Year Warranty)
 1. Concrete with %RH <99%, MVER <=10, pH < 11
 - 1) Apply USG Advanced skim coat as necessary for patch/skim coat.
 - 2) Install flooring with Shaw 4151* adhesive.
 2. Concrete with %RH >= 99%, MVER <=12, pH <= 12
 - 1) Apply Shaw Surface Prep EXT followed by Shaw Moisture Shield.
 - 2) Apply USG Advanced skim coat as necessary for patch/skim coat.
 - 3) Install flooring with Shaw 4151* adhesive.
 3. Concrete with %RH >= 99%, MVER <= 17, pH > 12
 - 1) Apply Surface Prep
 - 2) Apply Shaw Moisture Shield.
 - 3) Apply MRP
 - 4) Apply USG Advanced Skim Coat as necessary for patch/skim coat.
 - 5) Install flooring with Shaw 4151* adhesive
 4. Concrete with %RH >= 99%, MVER >17, pH > 12
 - 1) Apply Shaw Surface Prep EXT followed by Shaw MoistureTek.
 - 2) Apply USG Advanced skim coat as necessary for patch/skim coat.
 - 3) Install flooring with Shaw 4151* adhesive.
- D. Adhesives:
 1. For EcoWorx (fiberglass reinforced):

Lokworx+ Carpet Tile Adhesive	15 lbs. 97% RH	pH 5-11
Lokworx Carpet Tile Adhesive	10 lbs. 95% RH	pH 5-11
Shaw 3800 indoor/outdoor:	8 lbs. 90% RH	pH 5-9
Shaw 4151 high moisture:	10 lbs. 99% RH	pH 12
LokDots dry adhesive:	No visible moisture	pH 12
LokWorx tabs:	10 lbs. 85 RH	pH 12
Mill-applied ES:	No visible moisture	
 2. For EcoLogix (attached cushion): All, excluding LokDots and LokWorx.
 3. For StrataWorx (light weight tile alternative to broadloom)

Lokworx+ Carpet Tile Adhesive	15 lbs. 97% RH	pH 5-11
Lokworx Carpet Tile Adhesive	10 lbs. 95% RH	pH 5-11
Shaw 3800 indoor/outdoor:	8 lbs. 90% RH	pH 5-9
Shaw 4151 high moisture:	10 lbs. 99% RH	pH 12

LokDots dry adhesive:
LokWorx tabs:

No visible moisture pH 12
10 lbs. 85 RH pH 12

- E. Transition Strip: FinishWorx, Micro Transition.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content, pH, smoothness and level.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet and cushion manufacturer.
 2. Subfloor finishes comply with requirements specified in Section 03 30 00: Cast-in-Place Concrete, for slabs receiving carpet.
 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. If dusting or powdering exists, seal the floor with a latex primer such as Shaw 9050.

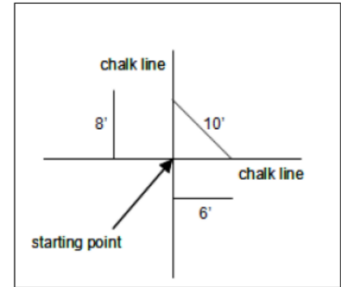
3.2 PREPARATION

- A. Substrates shall be smooth, structurally sound, permanently dry, clean and free of all foreign material such as dust, wax, solvents, paint, grease, oils, old adhesive residue, curing and hardening/ curing compounds, sealers and other foreign material that might prevent adhesive bond.
- B. Pre-existing Adhesive
1. Remove existing adhesives to prevent adhesive incompatibility /reactions and bonding issues.
 2. Cutback Adhesive: Wet scrape the adhesive, reduce to a well bonded residue and encapsulate with a product such as Shaw MRP.
 3. Do not use adhesive removers, they will adversely affect the new adhesive and product installed.
- C. Fill depressions or cracks with a cementitious patching/leveling compound that meets or exceeds the required moisture level and pH requirements. Use of gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the compressive strength of 3,000 psi are acceptable.
- D. Flooring considerations:
1. Installing over VCT and VAT: Tiles must be secure to the subfloor. Strip any wax from the surface.
 2. Installing over wood subfloors: Prime with a liquid latex such as Shaw 9050.
 3. Installing over raised access flooring: Must be smooth, level, secure and clean. Install carpet tile at an offset from panel seams. Gaps must not exceed 1/16" (1.6 mm).

3.3 INSTALLATION

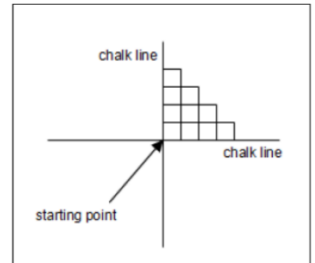
- A. Refer to Drawings and Finish Schedule for installation patterns.

- B. Start the tile installation as near to the center of the room as possible and position it to use the largest perimeter cut tile size.
- C. Snap a chalk line parallel to one major wall bisecting the starting point. It may be necessary to offset the center chalk line to assure perimeter tiles will be at least half size.
- D. Snap a second chalk line from the starting point at 90° to the first line. Use a 3-4-5, 6-8-10, or larger triangle depending on the room size. Meters or feet may be used to lay out the triangle in these proportions.



- E. Use a full spread of adhesive applied with a 3/8" foam paint roller or 1/16 x 1/32 x 5/64 u-notch trowel. The adhesive must be allowed to dry completely before installing the carpet. Installing into wet adhesive will result into a permanent bond and may cause the carpet to bubble. Trowel application of adhesive is recommended for EcoLogix. EcoWorx ES / EcoLogix ES no adhesive required. Approximate coverage rates are 35-40 yards per gallon when applied with a roller, and 28 -33* yards per gallon when applied with a trowel.
- F. Install each full carton and complete an entire pallet before starting another pallet to minimize product variation. Each tile has directional arrows on the back. These arrows allow for one-directional or multi-directional installation. Some styles may be large scale or linear in design and require quarter turning. If you are unsure about whether or not your product requires a quarter turned installation, please contact 1.877.502.7429. Numbers within the arrows are for manufacturing purposes and are not related to installation.

- G. Begin installation at the intersection of two chalk lines. Continue until you complete one quadrant. Proceed to an adjoining quadrant until all four quadrants are completed. Larger areas may require chalk lines bisecting the original four quadrants.



- H. Install tiles using the pyramid technique. This gives you multiple alignment checks. If the edges do not align and the misalignment increases with progression of the installation, find and correct the source of the problem.
- I. Carpet tiles come in various sizes. All Shaw tiles have directional arrows on the back of the tile. Slide tiles into position to prevent yarn from being trapped between the tiles. Trapped yarn will adversely affect the appearance of the installation and will cause alignment problems.
- J. EcoWorx ES /EcoLogix ES are manufactured with the adhesive already applied. Once the tile is ready to install, simply peel the liner from the back and position snugly to the adjacent tile.
- K. Tiles must fit snugly, but not be compressed. Press the entire surface of the tile to ensure adhesion. Check for fit by measuring the length of ten full tiles after installation. The measurement must not be less than, or exceed by more than 1/4 inch, the length of the tiles being multiplied by ten. For example: if 24" X 24" tiles are being installed, the measurement should be between 240 and 240 1/4 inches.
- L. Measure and cut tiles from the back using a straight edge. Be sure the arrows are pointing in the correct direction.
- M. Roll the entire installation with a 75 lb. or greater roller to assure the proper adhesion to the

substrate.

3.4 CLEANING AND PROTECTING

- A. Post-installation Care
1. Place plywood over the carpet when heavy objects will be moved within 24 hours after installation.
- B. Preventative Floor Care
1. Use protective chair mats under chairs with casters.
 2. Use soil removal mats at exterior entrances.
 3. Use absorbent mats in areas where moisture, oil and grease are present.
- C. Routine Maintenance
1. Set a schedule depending on traffic and vacuum regularly.
 2. Remove spots with spot removers as soon as they occur.
 3. Use encapsulation agents periodically.
 4. Clean with hot water extraction periodically.

Traffic Level	Vacuum	Spot Removal	Interim Cleaning	Hot Water Extraction
Light	2/week	As needed	As needed	1/year
Moderate	1/day	As needed	As needed	2/year
Heavy	1/day	As needed	Monthly	4/year
Extra Heavy	1/day	As needed	Weekly	Monthly

END OF SECTION

SECTION 09 72 16 - VINYL TACKBOARD

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Vinyl-covered fabric tackboard.
 - 2. Accessories.
- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry
 - 2. Section 09 21 16: Gypsum Board
 - 3. Section 09 90 00: Painting and Coating

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and technical data.
 - 2. Manufacturer's installation instructions.
- B. Samples: 8 inch by 10 inch samples showing manufacturer's full range of colors, textures and patterns for Architect's selection.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Fabricator/Installer: Company specializing in application of the work of this Section with minimum 3 years' experience.
- B. Single Source Responsibility: Obtain wallcovering system components from a single source.
- C. Wall covering must carry the maximum UL Fire Hazard classification (Class A) when tested in accordance with ASTM E84.
- D. Wall covering must meet CFFA-W-101.
- E. Section 803.1.1 of the 2022 California Building Code:
 - 1. Interior Wall and Ceiling Finish to meet Class A Requirements:
 - a. Flame spread index 0-25.
 - b. Smoke-developed index 0-450.
- F. Adhesives shall conform to the low-emitting material requirements of San Joaquin Valley Air Pollution Control District. SJVAPCD.
- G. Mock-ups: Prepare mock-ups for architect's review and to establish requirements for seaming and finish trim.
 - 1. Correct areas, modify method of application/installation, or adjust finish texture as directed by architect to comply with specified requirements.

2. Maintain mock-ups accessible to serve as a standard of quality.
3. Install each type of wallcovering specified.
4. Install in areas designated by architect.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperature within the building at not less than 68 degrees Fahrenheit for a minimum of seventy-two hours prior to beginning of installation.
 1. Do not install wallcovering until the space is enclosed and weatherproof.
 2. Do not install wallcovering until temperature is stabilized and permanent lighting is in place.

1.6 WARRANTY

- A. Submit a written warranty for the period of two (2) years after the date of "Notice of Completion," executed by the installer and manufacturer, agreeing to repair or replace wall covering materials that fail in materials or workmanship within the specified warranty period. This warranty shall be in addition to, and not a limitation of, other rights the District may have against the Contractor under the Contract documents.
 1. Submit manufacturer's warranty against manufacturing defects.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in packages, labeled to identify manufacturer, brand name, lot number, quality or grade, and fire hazard classification. Store inside in original, undamaged packaging, in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
- B. Schedule installation to minimize damage and soiling. Replace materials damaged prior to substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers listed whose products meet or exceed those specified are approved for use on the Project. Other manufacturers shall have a minimum of five (5) years' experience manufacturing products meeting or exceeding those specified and shall comply with Division 01 requirements for substitutions in order to be considered:
 1. Basis of Design:
 - a. Western Building Products.
 2. Acceptable alternative manufacturers are subject to compliance with design requirements.

2.2 VINYL TACKBOARD

- A. Physical Properties:
 1. Material: Vinyl.
 2. Backing: Woven
 3. Pattern Match: Random Match, Reverse Hang
 4. Type / Fire Rating: Type II / Class A.
 5. Width: 54 inches
 6. Gauge: 26 mils.
 7. Fabric: Woven.
 8. Bacteria Resistance: Provide manufacturers standard anti-microbial additive.

9. Style: As indicated on Drawings.
10. Color: As indicated on Drawings.
11. Location: As indicated on Drawings.

- B. Fiberboard core system:
1. Core: 1/2 inch thick, fiberboard complying with ASTM C208, medium density cellulose fiber insulating board.
 2. Fabric Installation: Fiberboard to be mechanically wrapped all 4 edges, square edges, where edges are exposed; only concealed edges do not require mechanical wrapping. No horizontal seams, from bottom to top.

2.3 ACCESSORIES

- A. Trims: Fabric-covered plastic and edge moldings and corner trims, manufacturer's standard, square butt joints with fabric-covered edges. Trim shall include top, bottom and end caps, inside and outside corners where required
- B. Adhesive shall be as recommended by tackboard manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Apply tackboard to substrate with adhesive in strict compliance with manufacturer's instructions.
- B. All attachments shall be concealed. Butt panels together with tight seams – plumb and straight. Vertical joints in the field shall have wrapped beveled edges but tightly with joints plumb.
- C. Fabricate re-wrapped edges where partial panels abut each other, adjacent surfaces, or trim.
- D. Re-wrap top, bottom, or side edges for cutting panels around door or window openings, abutting trim, protruding objects, and at other openings, including x-cut at receptables, light switches, and other openings:
1. Wrap minimum 4 inches around back of panel, typical.
 2. Carefully cut insulating board, leaving vinyl wall covering intact. Wrap wall covering tightly around edge of board and adhere continuously around back of panel with manufacturer's recommended vinyl wall covering adhesive.

3.2 APPLICATION

- A. Do not begin until all walls are clean, dry, true and free of irregularities. Inspect surfaces before commencing work and report defects to General Contractor.
- B. Before beginning application of vinyl wall covering, confirm products for uniform color, texture and quality.
- C. Commencement of work will be an indication that the wall covering subcontractor accepts the scheduled walls as being free of imperfections.
- D. Check walls for moisture with a moisture meter and obtain readings of 5% or less before proceeding with installation.

- E. Ensure wall surface flatness tolerance does not vary more than 1/8" in 10' nor vary at a rate greater than 1/16" per running foot.
- F. Fill nicks gouges, and other minor imperfections of wall surfaces with latex filler. Sand smooth flush with surface. Follow with prime coat sealer recommended by wall covering manufacturer.
- G. Remove rust dirt, and grease from metal surfaces. Prime with recommended metal primer.
- H. Remove switch plates, wall plates, and surface mounted fixtures in areas where wall covering is to be applied.
- I. Apply one (1) coat of primer in accordance with the printed instructions of manufacturer.
- J. Apply vinyl wall covering vertically in lot and roll number sequence.
- K. Use butt joints only (no overlapping).
- L. Trim vinyl wall covering to within 3/4 inch of top of scheduled base.

3.3 CLEANING

- A. At completion of job, clean all paste residue and matter from surfaces.
- B. Assure that all joints have achieved continuous lamination.

END OF SECTION 09 72 16

**SECTION 09 91 23
PAINTING**

PART 1 - GENERAL

1.01 SECTION INCLUDEES

- A. Interior paint and coatings systems including: paint and opaque finishes.
- B. Related Requirements:
 - 1. Section 09 29 00 - Gypsum Board

1.02 REFERENCES

- A. SSPC-SP 1 - Solvent Cleaning
- B. SSPC-SP 2 - Hand Tool Cleaning
- C. SSPC-SP 3 - Power Tool Cleaning
- D. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete
- E. EPA-Method 24
- F. SCAQMD Rule1113 -7/01/2007

1.03 SUBMITTALS

- A. Submit under provisions of the General Conditions - Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each paint and coating product should include:
 - 1. Product characteristics
 - 2. Surface preparation instructions and recommendations
 - 3. Primer requirements and finish specification
 - 4. Storage and handling requirements and recommendations
 - 5. Application methods
 - 6. Cautions
- C. Selection Samples: Submit a complete set of color chips that represent the full range of manufactures color samples available.
- D. Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.
- E. Submit Zero VOC and / or SCAQMD compliant products only.

1.04 MOCK-UP

- A. Include a mock-up if the project size and/or quality warrant taking such a precaution. The following is one example of how a mock-up on a large project might be specified. When deciding on the extent of the mock-up, consider all the major different types of painting on the project

1. Finish surfaces for verification of products, colors, & sheens
2. Finish area designated by Architect
3. Provide samples that designate prime & finish coats
4. Do not proceed with remaining work until the Architect approves the mock-up samples

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacture's name, label, and the following list of information:
1. Product name, and type (description)
 2. Application & use instructions
 3. Surface preparation
 4. VOC content
 5. Environmental issues
 6. Batch date
 7. Color number
- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- C. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.06 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Specified Manufacturer: Products of the Sherwin-Williams Company are the basis of design products specified to establish the level of quality.
1. Sherwin Williams
101 Prospect Avenue NW
Cleveland, OH 44115
Tel: (800) 321-8194
Fax: (216) 566-1392
www.sherwin-williams.com
- B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 – Substitution Procedures. When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product.

2.02 APPLICATION/SCOPE

- A. Use this article to define the scope of painting if not fully defined in a Finish Schedule or on the drawings. This article must be carefully edited to reflect the surfaces actually found on the project. In some cases, it may be enough to use the first paragraph that says, in effect, "paint everything" along with a list of items not to paint, without exhaustively defining all the different surfaces and items that must be painted.
- B. If the project involves repainting some but not all existing painted surfaces, be sure to indicate the extent of the repainting.
- C. The descriptions of each system can also be used to further refine the definition of what is to be painted, stained, or clear finished.
- D. Industrial Maintenance Coatings are coatings, including primers, sealers, undercoaters, intermediate coatings and topcoats, formulated for or applied to substrates, including floors that are exposed to one or more of the following extreme environmental conditions:
 - 1. Immersion in water, wastewater, or chemical solutions (aqueous and non-aqueous solutions), or chronic exposure of interior surfaces to moisture condensation;
 - 2. Acute or chronic exposure to corrosive, caustic or acidic agents, or similar chemicals, chemical fumes, chemical mixtures, or solutions;
 - 3. Repeated exposure to temperatures in excess of 250 degrees Fahrenheit;
 - 4. Repeated heavy abrasion, including mechanical wear and repeated scrubbing with industrial solvents, cleaners, or scouring agents; or
 - 5. Exterior exposure of metal structures.
- E. Surfaces To Be Coated Include:
 - 1. Cement - Poured, Precast, Tilt-Up, Cast-In-Place, Cement Board
 - 2. Masonry - (CMU - Concrete, Split Face, Scored, Smooth, etc.)
 - 3. Metal – Ferrous and Non-Ferrous
 - 4. Metal - Galvanized
 - 5. Metal - (Ceilings-Structural Steel, Joists, Trusses, Beams, Partitions, Cabinets, Lockers, etc.)
 - 6. Wood - Walls, Doors, Trim, Cabinet Work, etc.
 - 7. Drywall
 - 8. Plaster / Gypsum Board - Walls, Ceilings

2.03 MATERIALS

- A. Paints and Coatings - General.
 - 1. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
 - 2. For opaque finishes, tint each coat including primers and finishes with Zero VOC colorants (Zero VOC, less exempt solvents).
 - 3. All ultra deep and vivid accent colors are to be tinted in Zero VOC finishes
- B. Primers:
 - 1. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.04 ACCESSORIES

A. Coating Application Accessories:

1. Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin application of coatings until substrates have been properly prepared. Notify Architect of unsatisfactory conditions before proceeding.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

3.02 PREPARATION

- A. The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.
- B. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry 48 hours before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
- C. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50°F unless the specified product is designed for the marginal conditions.
- D. Methods
 1. Aluminum:
 - a. Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
 2. Block (Cinder and Concrete):
 - a. Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75°F. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.

3. Concrete, SSPC-SP13 or NACE 6:
 - a. This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.
4. Cement Composition Siding/Panels:
 - a. Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.
5. Copper and Stainless Steel:
 - a. Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP 2, Hand Tool Cleaning.
6. Drywall—Interior:
 - a. Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.
7. Galvanized Metal
 - a. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.
8. Plaster
 - a. Must be allowed to dry thoroughly for at least 30 days before painting, unless the products are designed to be used in high pH environments. Room must be ventilated while drying; in cold, damp weather, rooms must be heated. Damaged areas must be repaired with an appropriate patching material. Bare plaster must be cured and hard. Textured, soft, porous, or powdery plaster should be treated with a solution of 1 pint household vinegar to 1 gallon of water. Repeat until the surface is hard, rinse with clear water and allow to dry.
9. Steel: Structural, Plate, etc.

- a. Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
10. Solvent Cleaning, SSPC-SP1
 - a. Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
 11. Hand Tool Cleaning, SSPC-SP2
 - a. Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
 12. Power Tool Cleaning, SSPC-SP3
 - a. Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
 13. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4
 - a. A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.
 14. Water Blasting, NACE Standard RP-01-72
 - a. Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.
 15. Vinyl Siding, Architectural Plastics, and Fiberglass
 - a. Clean thoroughly by scrubbing with a warm, soapy water solution. Rinse thoroughly. Do not paint vinyl siding with any color darker than the original color unless the product and colors are designed for such use. Painting with darker colors may cause siding to warp.
 16. Wood

- a. Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

17. **WARNING!** Removal of old paint by sanding, scraping or other means may generate dust or fumes that contain lead. Exposure to lead dust or fumes may cause brain damage or other adverse health effects, especially in children or pregnant women. Controlling exposure to lead or other hazardous substances requires the use of proper protective equipment, such as a properly fitted respirator (NIOSH approved) and proper containment and cleanup. For more information, call the National Lead Information Center at 1-800-424-LEAD (in US) or contact your local health authority.

3.03 INSTALLATION

- A. Apply all coatings and materials with manufacture specifications in mind. Mix all coatings according to manufacture recommendation. Do not thin paints and coatings unless directed according to manufacturer's instructions.
- B. Do not apply to wet or damp surfaces.
 1. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days.
 2. Test new concrete for moisture content.
- C. Apply coatings using methods recommended by manufacturer.
- D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.
- E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.
- F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.
- G. Inspection: The coated surface must be inspected and approved by the Architect or Engineer just prior to each coat.

3.04 PROTECTION

- A. A Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

3.05 SCHEDULE – INTERIOR

- A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up, Cast-In-Place)
 1. Latex Systems

- a. Semi-Gloss Finish
 - 1) 1st Coat: S-W Loxon Primer, A24W300
 - 2) 2nd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600
 - 3) 3rd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600
 - b. Eggshell Finish
 - 1) 1st Coat: S-W Loxon Primer, A24W300
 - 2) 2nd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600
 - 3) 3rd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600
 - c. Flat Finish
 - 1) 1st Coat: S-W Loxon Primer, A24W300
 - 2) 2nd Coat: S-W ProMar 200 Zero VOC Flat, B30-2600
 - 3) 3rd Coat: S-W ProMar 200 Zero VOC Flat, B30-2600
2. High Performance Latex System (for greater abrasion resistance)
- a. Semi-Gloss Finish
 - 1) 1st Coat: S-W Loxon Primer, A24W300
 - 2) 2nd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series
 - 3) 3rd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series
3. High Performance Epoxy System (for greater chemical and abrasion resistance)
- a. Gloss Finish
 - 1) 1st Coat: S-W Loxon Primer, A24W300
 - 2) 2nd Coat: S-W Pro Industrial Zero VOC WB Epoxy Gloss, B73 Series
 - 3) 3rd Coat: S-W Pro Industrial Zero VOC WB Epoxy Gloss, B73 Series
 - b. Eggshell Finish
 - 1) 1st Coat: S-W Loxon Primer, A24W300
 - 2) 2nd Coat: S-W Pro Industrial Zero VOC WB Epoxy Eggshell, B73 Series
 - 3) 3rd Coat: S-W Pro Industrial Zero VOC WB Epoxy Eggshell, B73 Series
- B. MASONRY - (CMU - Concrete, Split Face, Scored, Smooth, High Density, Low Density, Fluted)
- 1. Latex Systems
 - a. Semi-Gloss Finish
 - 1) 1st Coat: S-W PrepRite Block Filler, B25W25

- 2) 2nd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600

b. Eggshell Finish

- 1) 1st Coat: S-W PrepRite Block Filler, B25W25
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600

c. Flat Finish

- 1) 1st Coat: S-W PrepRite Block Filler, B25W25
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Flat, B30-2600
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Flat, B30-2600

2. High Performance Latex System (for greater abrasion resistance)

a. Semi-Gloss Finish

- 1) 1st Coat: S-W PrepRite Block Filler, B25W25
- 2) 2nd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series
- 3) 3rd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series

3. High Performance Epoxy System (for greater chemical and abrasion resistance)

a. Gloss Finish

- 1) 1st Coat: S-W PrepRite Block Filler, B25W25
- 2) 2nd Coat: S-W Pro Industrial Zero VOC WB Epoxy Gloss, B73 Series
- 3) 3rd Coat: S-W Pro Industrial Zero VOC WB Epoxy Gloss, B73 Series

b. Eggshell Finish

- 1) 1st Coat: S-W PrepRite Block Filler, B25W25
- 2) 2nd Coat: S-W Pro Industrial Zero VOC WB Epoxy Eggshell, B73 Series
- 3) 3rd Coat: S-W Pro Industrial Zero VOC WB Epoxy Eggshell, B73 Series

C. FERROUS and Non-Ferrous METAL - (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Structural Iron, Ferrous Metal)

1. Latex Systems

a. Semi-Gloss Finish

- 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600

- 3) 3rd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600

b. Eggshell Finish

- 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600

c. Flat Finish

- 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Flat, B30-2600
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Flat, B30-2600

2. High Performance Latex System (for greater abrasion resistance)

a. Semi-Gloss Finish

- 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
- 2) 2nd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series
- 3) 3rd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series

3. High Performance Epoxy System (for greater chemical and abrasion resistance)

a. Gloss Finish

- 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
- 2) 2nd Coat: S-W Pro Industrial Zero VOC WB Epoxy Gloss, B73 Series
- 3) 3rd Coat: S-W Pro Industrial Zero VOC WB Epoxy Gloss, B73 Series

b. Eggshell Finish

- 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
- 2) 2nd Coat: S-W Pro Industrial Zero VOC WB Epoxy Eggshell, B73 Series
- 3) 3rd Coat: S-W Pro Industrial Zero VOC WB Epoxy Eggshell, B73 Series

D. WOOD- (Doors, Trim, Cabinet Work, Partitions, Frames)

1. Latex Systems

a. Semi-Gloss Finish

- 1) LOW ODOR/ZERO VOC

- 2) 1st Coat: S-W PrepRite ProBlock Latex Primer, B51 Series
- 3) 2nd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600
- 4) 3rd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600

b. Eggshell Finish

- 1) LOW ODOR/ZERO VOC
- 2) 1st Coat: S-W PrepRite ProBlock Latex Primer, B51 Series
- 3) 2nd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600
- 4) 3rd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600

2. High Performance Latex System (for greater abrasion resistance)

a. Semi-Gloss Finish

- 1) 1st Coat: S-W PrepRite ProBlock Latex Primer, B51 Series
- 2) 2nd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series
- 3) 3rd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series

E. DRYWALL (Walls, Ceilings, Gypsum Board, Wood Pulp Board, Plaster Board, etc.)

1. Latex Systems

a. Semi-Gloss Finish

- 1) 1st Coat: S-W ProMar 200 Zero VOC Primer B28 Series
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Semi-Gloss, B31-2600

b. Eggshell Finish

- 1) 1st Coat: S-W ProMar 200 Zero VOC Primer B28 Series
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Eggshell, B20-2600

c. Flat Finish

- 1) 1st Coat: S-W ProMar 200 Zero VOC Primer B28 Series
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Flat, B30-2600
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Flat, B30-2600

2. High Performance Latex System (for greater abrasion resistance)

a. Semi-Gloss Finish

- 1) 1st Coat: S-W ProMar 200 Zero VOC Primer B28 Series
- 2) 2nd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series

- 3) 3rd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series
3. High Performance Epoxy System (for greater chemical and abrasion resistance)
 - a. Gloss Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Primer B28 Series
 - 2) 2nd Coat: S-W Pro Industrial Zero VOC WB Epoxy Gloss, B73 Series
 - 3) 3rd Coat: S-W Pro Industrial Zero VOC WB Epoxy Gloss, B73 Series
 - b. Eggshell Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Primer B28 Series
 - 2) 2nd Coat: S-W Pro Industrial Zero VOC WB Epoxy Eggshell, B73 Series
 - 3) 3rd Coat: S-W Pro Industrial Zero VOC WB Epoxy Eggshell, B73 Series

3.06 EXTERIOR

- A. CONCRETE - (Cementitious Siding, Flexboard, Transite Board, Shingles (Non-Roof), Common Brick, Stucco, Tilt-up, Precast, and Poured-in-place Cement)
 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W Loxon® Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series
 - 3) 3rd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)
 - b. Semi-Gloss
 - 1) 1st Coat: S-W Loxon® Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
 - 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
 - 3) 3rd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)
 - c. Satin Finish
 - 1) 1st Coat: S-W Loxon® Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Satin, A82 Series
 - 3) 3rd Coat: S-W A-100® Exterior Latex Satin, A82 Series
 - 4) (4 mils wet, 1.4 mils dry per coat)
 - d. Flat Finish

- 1) 1st Coat: S-W Loxon® Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Flat, A6 Series
 - 3) 3rd Coat: S-W A-100® Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)
 - 4) 1st Coat: S-W Sher-Crete® Flexible Concrete Waterproof, A5 Series
 - 5) 2nd Coat: S-W Sher-Crete® Flexible Concrete Waterproof, A5 Series (14-18 mils wet per coat)
- B. CONCRETE - (Cementitious Siding, Flexboard, Transite Board, Shingles (Non-Roof), Common Brick, Stucco, Tilt-up, Precast, and Poured-in-place Cement)
1. Elastomeric System (not including; cementitious siding, Flexboard, Transite board, shingles)
 - a. Flat Finish
 - 1) Low VOC Topcoat
 - 2) 1st Coat: S-W Loxon® Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
 - 3) 2nd Coat: S-W ConFlex XL Elastomeric High Build Coating, A5-400 Series
 - 4) 3rd Coat: S-W ConFlex XL Elastomeric High Build Coating, A5-400 Series (16 mils wet, 7.5 mils dry per coat)
 2. Textured Elastomeric System
 - a. Flat Finish
 - 1) 1st Coat: S-W Loxon® Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
 - 2) 2nd Coat: S-W ConFlex XL Elastomeric High Build Coating, A5-400 Series (16 mils wet, 7.5 mils dry per coat)
 - 3) 3rd Coat: S-W ConFlex XL Textured Elastomeric High Build Coating, A5-800 (Fine, Medium, Extra Coarse) (20 mils wet, 9.4 mils dry per coat)
 3. Textured & Smooth Systems
 - a. Textured Water Based Finish
 - 1) Low VOC Topcoat
 - 2) 1st Coat: S-W Loxon® XP Smooth, A24W400 Series (14-18 mils wet; 6.4-8.3 mils dry)
 - 3) 2nd Coat: S-W Loxon® XP Fine Textured Waterproofing System, A24-750 Series (14-18 mils wet)
 - b. Smooth Water Based Finish
 - 1) 1st Coat: S-W Loxon® XP, A24W400 Series (14-18 mils wet; 6.4-8.3 mils dry)
 - 2) 2nd Coat: S-W Loxon® XP, A24W400 Series (14-18 mils wet; 6.4-8.3 mils dry) optional

- C. CONCRETE - (Cementitious Siding, Flexboard, Transite Board, Shingles (Non-Roof), Common Brick, Stucco, Tilt-up, Precast, and Poured-in-place Cement)
 - 1. Stain System
 - a. Solid Color Waterborne Finish
 - 1) 1st Coat: S-W Vertical Concrete Stain, A31 Series
 - 2) 2nd Coat: S-W Vertical Concrete Stain, A31 Series (50-250 sq ft/ gal)
 - 2. Clear Water Repellant
 - a. Clear
 - 1) 1st Coat: S-W Loxon® 7% Siloxane Water Repellant, A10T7
 - 2) 2nd Coat: S-W Loxon® 7% Siloxane Water Repellant, A10T7 (50-200 sq ft/ gal)
- D. MASONRY - (Concrete Masonry Units [CMU]- Cinder or Concrete Block)
 - 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W PrepRite® Block Filler, B25W25(75-100 sq ft/gal)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series
 - 3) 3rd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)
 - b. Semi-Gloss Finish
 - 1) 1st Coat: S-W PrepRite® Block Filler, B25W25 (75-100 sq ft/gal)
 - 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
 - 3) 3rd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)
 - c. Satin Finish
 - 1) 1st Coat: S-W PrepRite® Block Filler, B25W25 (75-100 sq ft/gal)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Satin, A82 Series
 - 3) 3rd Coat: S-W A-100® Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)
 - d. Flat Finish
 - 1) 1st Coat: S-W PrepRite® Block Filler, B25W25 (75-100 sq ft/gal)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Flat, A6 Series
 - 3) 3rd Coat: S-W A-100® Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)

- 4) 1st Coat: S-W Sher-Crete® Flexible Concrete Waterproofer, A5 Series
- 5) 2nd Coat: S-W Sher-Crete® Flexible Concrete Waterproofer, A5 Series (14-18 mils wet per coat)

E. MASONRY - (Concrete Masonry Units [CMU]- Cinder or Concrete Block)

1. Elastomeric System

a. Flat Finish

- 1) 1st Coat: S-W Loxon® Block Surfacer, A24W200 (50-100 sq ft/gal)
- 2) 2nd Coat: S-W ConFlex XL Elastomeric High Build Coating, A5-400 Series
- 3) 3rd Coat: S-W ConFlex XL Elastomeric High Build Coating, A5-400 Series (16 mils wet, 7.5 mils dry per coat)

b. Alternate

- 1) 1st Coat: S-W Loxon® Block Surfacer, A24W200 (50-100 sq ft/gal)
- 2) 2nd Coat: S-W Sherlastic Elastomeric Coating, A5-Series
- 3) 3rd Coat: S-W Sherlastic Elastomeric Coating, A5-Series (14 mils wet, 6 mils dry per coat)

2. Textured Elastomeric System

a. Flat Finish

- 1) 1st Coat: S-W Loxon® Block Surfacer, A24W200 (50-100 sq ft/gal)
- 2) 2nd Coat: S-W ConFlex XL Elastomeric High Build Coating, A5-400 Series (16 mils wet, 7.5 mils dry per coat)
- 3) 3rd Coat: S-W ConFlex XL Textured Elastomeric High Build Coating, A5-800 (Fine, Medium, Extra Coarse) (20 mils wet, 9.4 mils dry per coat)

3. Textured & Smooth Masonry Systems

a. Textured Water Based Finish b

- 1) 1st Coat: S-W Loxon® XP Smooth, A24W400 Series (14-18 mils wet; 6.4-8.3 mils dry)
- 2) 2nd Coat: S-W Loxon® XP Fine Textured Waterproofing System, A24-750 Series (14-18 mils wet)

b. Smooth Water Based Finish

- 1) 1st Coat: S-W Loxon® XP, A24W400 Series (14-18 mils wet; 6.4-8.3 mils dry)
- 2) 2nd Coat: S-W Loxon® XP, A24W400 Series (14-18 mils wet; 6.4-8.3 mils dry) optional

F. MASONRY - (Concrete Masonry Units [CMU]- Cinder or Concrete Block)

1. Stain System
 - a. Solid Color Waterborne Finish
 - 1) 1st Coat: S-W Vertical Concrete Stain, A31 Series
 - 2) 2nd Coat: S-W Vertical Concrete Stain, A31 Series (50-250 sq ft/ gal)
 2. Clear Water Repellant
 - a. Clear
 - 1) 1st Coat: S-W Loxon® 7% Siloxane Water Repellant, A10T7
 - 2) 2nd Coat: S-W Loxon® 7% Siloxane Water Repellant, A10T7 (50-200 sq ft/ gal)
- G. CONCRETE- (Concrete Floors, Patios, Porches, Steps & Platforms)
1. Acrylic Water-Based Floor System
 - a. Satin Finish
 - 1) 1st Coat: S-W Porch & Floor Enamel, A32-200 Series
 - 2) 2nd Coat: S-W Porch & Floor Enamel, A32-200 Series (4mils wet; 1.4 mils dry per coat)
 - b. Low Luster Finish
 - 1) 1st Coat: S-W Sher-Crete® Flexible Concrete Waterproof, A5 Series (14-18 mils wet)
 - 2) 2nd Coat: S-W H&C Concrete Stain Water Based Clear
 - 3) 3rd Coat: S-W H&C Concrete Stain Water Based Clear (50-250 sq ft/ gal)
 - c. Flat Finish
 - 1) 1st Coat: S-W Sher-Crete® Flexible Concrete Waterproof, A5 Series
 - 2) 2nd Coat: S-W Sher-Crete® Flexible Concrete Waterproof, A5 Series (14-18 mils wet per coat)
 2. Solid Stain Finish
 - a. Low Luster Finish
 - 1) 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
 - 2) 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-250 sq ft/ gal)
- H. METAL - (Aluminum, Galvanizing)
1. Latex Systems
 - a. Gloss Finish

- 1) 1st Coat: S-W A-100® Exterior Latex Gloss, A8 Series
 - 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)
 - b. Semi-Gloss Finish
 - 1) 1st Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
 - 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)
 - c. Satin Finish
 - 1) 1st Coat: S-W A-100® Exterior Latex Satin, A82 Series
 - 2) 2nd Coat: S-W A-100® Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)
 - d. Flat Finish
 - 1) 1st Coat: S-W A-100® Exterior Latex Flat, A6 Series
 - 2) 2nd Coat: S-W A-100® Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)
- I. METAL - Ferrous (Structural Iron & Steel, Tanks, Water Towers, Sashes, Trim, Conductors, Doors, Ducts, Vents, (Non-Galvanized))
 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W Pro Industrial® Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series
 - 3) 3rd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)
 - b. Semi-Gloss Finish
 - 1) 1st Coat: S-W Pro Industrial® Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
 - 3) 3rd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)
- J. WOOD (Siding, Trim, Shutters, Sashes, Hardboard-Bare/Primed)
 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series

- 3) 3rd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)

b. Semi-Gloss

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
- 3) 3rd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)

c. Satin Finish

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Satin, A82 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)

d. Flat Finish

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Flat, A6 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)

K. WOOD (Siding, Trim, Shutters, Sashes, Hardboard-Bare/Primed)

1. Latex Systems

a. Gloss Finish

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)

b. Semi-Gloss

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
- 3) 3rd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)

c. Satin Finish

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Satin, A82 Series

- 3) 3rd Coat: S-W A-100® Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)
- d. Flat Finish
 - 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W A-100® Exterior Latex Flat, A6 Series
 - 3) 3rd Coat: S-W A-100® Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)
- L. WOOD (Siding, Trim, Shutters, Sashes, Hardboard-Bare/Primed)
 - 1. Stain - Water Reducible Systems
 - a. Solid Color
 - 1) 1st Coat: S-W WoodScapes® Solid Color Stain, A15 Series
 - 2) 2nd Coat: S-W WoodScapes® Solid Color Stain, A15 Series (200-400 sq ft/gal)
 - b. Semi-Transparent
 - 1) 1st Coat: S-W WoodScapes® Semi-Transparent Stain, A15T5
 - 2) 2nd Coat: S-W WoodScapes® Semi-Transparent Stain, A15T5 (200-350 sq ft/gal)
- M. Wood Decks, Exterior (including pressure treated lumber)
 - 1. Stain - Solid Color Acrylic Latex
 - a. Satin Finish
 - 1) 1st Coat: S-W DeckScapes® Acrylic Solid Color Deck Stain, A15-150 Series
 - 2) 2nd Coat: S-W DeckScapes® Acrylic Solid Color Deck Stain, A15-150 Series (300-500 sq ft/gal)
 - 2. Semi-Transparent-Waterborne Alkyd/Acrylic
 - a. Flat Finish
 - 1) 1st Coat: S-W DeckScapes® Ext. Waterborne Deck Stain, A15T15 Series
 - 2) 2nd Coat: S-W DeckScapes® Ext. Waterborne Deck Stain, A15T15 Series
 - 3) (100-300 sq ft/ per gal)
 - 3. Toner Sealer System
 - a. Semi-Transparent Stain
 - 1) 1st Coat: S-W DeckScapes® Ext. Waterborne Toner, A15T452
 - 2) 2nd Coat: S-W DeckScapes® Ext. Waterborne Toner, A15T452 (150-300 sq ft/gal)

N. ARCHITECTURAL PVC, PLASTIC, FIBERGLASS (due to the variety of substrate, check for compatibility)

1. Latex Systems

a. Gloss Finish

- 1) 1st Coat: S-W PrepRite® ProBlock® Latex Primer, B51 Series (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)

b. Semi-Gloss

- 1) 1st Coat: S-W PrepRite® ProBlock® Latex Primer, B51 Series (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
- 3) 3rd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)

c. Satin Finish

- 1) 1st Coat: S-W PrepRite® ProBlock® Latex Primer, B51 Series (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Satin, A82 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)

d. Flat Finish

- 1) 1st Coat: S-W PrepRite® ProBlock® Latex Primer, B51 Series (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Flat, A6 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)

O. DRYWALL (Gypsum Board, Exterior Drywall)

1. Latex Systems

a. Gloss Finish

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)

b. Semi-Gloss

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
- 3) 3rd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)

c. Satin Finish

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Satin, A82 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)

d. Flat Finish

- 1) 1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
- 2) 2nd Coat: S-W A-100® Exterior Latex Flat, A6 Series
- 3) 3rd Coat: S-W A-100® Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)

P. VINYL SIDING*, EIFS, SYNTHETIC STUCCO

1. Latex Systems

a. Gloss Finish

- 1) 1st Coat: S-W A-100® Exterior Latex Gloss, A8 Series
- 2) 2nd Coat: S-W A-100® Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat)

b. Semi-Gloss

- 1) 1st Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series
- 2) 2nd Coat: S-W Sonoran Int/Ext Acrylic Latex Semi-Gloss, B40WJ9850 Series (4 mils wet, 1.5 mils dry per coat)

c. Satin Finish

- 1) 1st Coat: S-W A-100® Exterior Latex Satin, A82 Series
- 2) 2nd Coat: S-W A-100® Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)

d. Flat Finish

- 1) 1st Coat: S-W A-100® Exterior Latex Flat, A6 Series
- 2) 2nd Coat: S-W A-100® Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)

END OF SECTION 09 91 23

SECTION 09 96 00 HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Exterior Substrates:
 - 1. Concrete.
- B. Reference Standards:
 - 1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 2. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 - 3. ASTM D3359 - Standard Test Method for Film Hardness by Pencil Test.
 - 4. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test.
 - 5. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abrader.
 - 6. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 - 7. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - 8. ASTM D6386 - Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
 - 9. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 10. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
 - 11. ICRI Guide No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays.
 - 12. SSPC-SP 3 - Power Tool Cleaning.
 - 13. SSPC-SP 6/NACE 3 - Commercial Blast Cleaning.
 - 14. SSPC-SP10 - Near White Blast Cleaning.
 - 15. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.
 - 16. SSPC-PA2 - Measurement of Dry Coating with Magnetic Gauges.

1.3 SUBMITTALS

- A. Product Data - Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Application instructions.
 - 4. Manufacturer's Safety Data Sheets.
- B. Shop Drawings - Submit a complete schedule of products proposed for use, including identifying product names and catalog numbers:
 - 1. Arrange in same format as Finish Schedule.
 - 2. Include applicable manufacturer's data and recommendations.

- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, minimum size 3 inches by 4 inches (76 mm by 102 mm) representing actual product, color, and patterns.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements and are suitable for intended application.
- F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of coatings specified.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications - Provide all products from a single manufacturer specializing in manufacture of high-performance textured acrylic finishes with a minimum of 10 years' experience:
 - 1. Materials shall be standard products of a single manufacturer.
 - 2. Secondary materials shall be specifically recommended by coating system manufacturer to ensure compatibility of systems.
- B. Applicator Qualifications: A firm documented experienced applying textured acrylic finishes similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance.
- C. Regulatory Requirements: Conform to all applicable codes and ordinances for flame, fuel, smoke and volatile organic compounds (VOC) ratings requirements for finishes at time of application.
- D. Mock-Up - Provide a mock-up for evaluation of surface preparation techniques and application workmanship:
 - 1. Located in areas designated by Architect.
 - 2. Prepare a surface preparation mock-up of each surface condition anticipated for the project.
 - 3. Prepare a 10-foot by 10-foot (3.05 m by 3.05 m) mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application.
 - 4. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 5. Refinish mock-up area as required to produce acceptable work.
 - 6. Retain mock-ups to establish intended standards by which surface preparation and coating systems will be judged.
- E. Pre-Construction Meeting:
 - 1. Convene a pre-application meeting two weeks before the start of application of wall coating system.
 - 2. Require attendance of parties directly affecting work of this section, including the Contractor, Architect, Owner's Representative, coating applicator, and a representative of coating material manufacturer.
 - 3. Items to be discussed at meeting shall include:
 - a. Review of Contract Documents and accepted shop drawings and deviations or differences resolved.
 - b. Establish areas on-site available for use as storage areas and working area.
 - c. Review project schedule, and the work that should be completed before coating

- application.
- d. Review environmental conditions, surface conditions, surface preparation, application procedures, and protection after application.
 - e. Review the surface preparation, application, cleaning, protection and coordination with other work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with manufacturer's labels clearly identifying product name and manufacturer and the following:
 - 1. Manufacturer and Coating or material name.
 - 2. Color name and number.
 - 3. Batch or lot number.
 - 4. Date of manufacture.
 - 5. Mixing and thinning instructions.
- B. Store materials in accordance with the manufacturer's instructions.
 - 1. Store materials in dry, enclosed area with adequate protection from moisture.
 - 2. Keep containers sealed until ready for use.
 - 3. At all times, coatings shall be protected from freezing.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- D. Protect materials during handling and application to prevent damage or contamination.

1.6 WARRANTIES

- A. Manufacturer's warranty:
 - 1. Dryvit's 10-year labor and materials warranty to repair or replace any products that do not perform as warranted.
 - 2. This warranty will be provided in combination with a Tremco warranty for coatings as a part of a separate building envelope project. The two combined warranties will cover the building envelope with complete coverage under the operating companies within the Tremco Construction Products Group.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Specifications are based on products of manufacturers specified. Basis of Design
Manufacturer: **Dryvit** or equal. Dryvit can be reached at: 209-765-9833.

2.2 MATERIALS - GENERAL REQUIREMENTS

F. TEST	TEST METHOD	CRITERIA	RESULTS
Abrasion Resistance	ASTM D 968	No deleterious effects after 528 quarts (500 liters)	No deleterious effects after 1056 quarts (1000 liters)

Accelerated Weathering	ASTM G 155 Cycle 1	No deleterious effects after 2000 hours	No deleterious effects after 5000 hours
	ASTM G 154 Cycle 1 (QUV)		No deleterious effects after 5000 hours
Freeze-Thaw	ASTM E 2485 (formerly EIMA 101.01)	No deleterious effects after 60 cycles	Passed - No deleterious effects after 90 cycles
	ASTM C 67 modified	No deleterious effects after 60 cycles	Passed - No deleterious effects after 60 cycles
	ICC ES Procedure	No deleterious effects after 10 cycles	Passed - No deleterious effects after 10 cycles
Mildew Resistance	ASTM D 3273	No growth during 28 day exposure period	No growth during 60 day exposure period
Moisture Resistance	ASTM D 2247	No deleterious effects after 14 days exposure	No deleterious effects after 42 days exposure
Taber Abrasion	ASTM D 4060	N/A	Passed 1000 cycles
Salt Spray Resistance	ASTM B 117	No deleterious effects after 300 hours exposure	No deleterious effects after 1000 hours exposure
Water Penetration***	ASTM E 331 ICC ES (AC219)	No water penetration beyond the inner-most plane of the wall after 2 hours at 6.24 psf (300 Pa)	Passed
Alkali Resistance of Reinforcing Mesh	ASTM E 2098 (formerly EIMA 105.01)	> 120 pli (21dN/cm) retained tensile strength after exposure	Passed
Water Vapor Transmission	ASTM E 96	Vapor permeable	EPS 5 perm-inch Base Coat* 40 perms Finish** 40 perms
Tensile Bond	ASTM C 297/E 2134	Minimum 15 psi (104 kPa) – substrate or insulation failure	Minimum 19.1 psi (132 kPa)
* Based on Dryvit Genesis® ** Based on Dryvit Quarzputz® *** TAFS Option 2			

2. Impact Resistance: In accordance with ASTM E 2486 (formerly EIMA Standard 101.86):

Reinforcing Mesh ¹ /Weight oz/yd ² (g/m ²)	Minimum Tensile Strengths	EIMA Impact Classification	EIMA Impact Range in-lbs (Joules)		Impact Test Results in-lbs (Joules)	
Standard - 4.3 (146)	150 lbs/in (27 g/cm)	Standard	25-49	(3-6)	36	(4)
Standard Plus TM - 6 (203)	200 lbs/in (36 g/cm)	Medium	50-89	(6-10)	56	(6)
Intermediate TM - 12 (407)	300 lbs/in (54 g/cm)	High	90-150	(10-17)	108	(12)
Panzer [®] 15 ² - 15 (509)	400 lbs/in (71 g/cm)	Ultra High	>150	(>17)	162	(18)
Panzer 20 ² - 20.5 (695)	550 lbs/in (98 g/cm)	Ultra High	>150	(>17)	352	(40)
Detail Mesh [®] Short Rolls – 4.3 (146)	150 lbs/in (27 g/cm)	n/a	n/a	n/a	n/a	n/a
Corner Mesh TM - 7.2 (244)	274 lbs/in (49 g/cm)	n/a	n/a	n/a	n/a	n/a
1. It shall be colored blue and bear the Dryvit logo for product identification 2. Shall be used in conjunction with Standard Mesh Values based on testing over EPS substrate						

3. Fire performance

TEST	TEST METHOD	CRITERIA	RESULTS
Flame Spread	ASTM E 84	All components shall have a Flame Spread Index ≤ 25 Smoke Developed Index ≤ 450	Passed

2.3 MATERIALS

- A. Portland Cement: Shall be Type I or Type II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.
- B. Water: Shall be clean and free from foreign matter.

2.4 COMPONENTS

- A. Base Coat: Shall be compatible with the substrate and reinforcing mesh.
 - 1. Ready mixed: A dry blend cementitious, co-polymer based product, field mixed with water.
 - a. Shall be Genesis DM by Dryvit.
- B. Reinforcing Meshes: Shall be a balanced open weave, glass fiber fabric treated for compatibility with other TAF materials.
 - 1. Shall be Standard by Dryvit, colored blue for product identification bearing the Dryvit logo.
- C. Primers:
 - 1. Color Prime by Dryvit: Pigmented acrylic based primer used to improve adhesion and uniformity of finish color.

- D. Finish: Shall be the type, color and texture as selected by the architect/owner and shall be the following:
 - 1. DPR Dirt Pickup Resistance (DPR): Water based acrylic coating with integral color and texture formulated with DPR chemistry:
 - a. Limestone finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to the application of the Dryvit TAFS, the contractor shall ensure that all needed waterproofing details have been completed, if such completion is required prior to the application of Dryvit TAFS.
- B. The contractor shall notify the architect of any discrepancies prior to work proceeding.

3.2 SURFACE PREPARATION

- A. The substrate shall be prepared so as to be free of foreign materials such as oil, dust, dirt, water repellents, moisture and any other materials that inhibit adhesion.
- B. Exposed aggregate: Power wash clean and allow to dry. Remove or grind down any aggregate that will not be sufficiently covered in the plane of the base coat.
- C. Painted surfaces: Power wash to remove any loose paint, chalk and other materials that may inhibit adhesion. Apply a test patch to verify adhesion prior to commencing the work.

3.3 INSTALLATION

- A. The Dryvit materials shall be mixed and applied in accordance with current Dryvit printed product data sheets.
- B. Exposed aggregate surfaces (buildings 100A, 100B, 200 and 400):
 - 1. Apply a continuous and generous layer of Genesis DM Base Coat over the existing substrate to fill voids and provide a smooth, level base for the system.
 - 2. Embed the Standard reinforcing mesh into the wet Genesis and trowel smooth.
 - 3. Apply an additional layer of the Genesis DM Base Coat, troweling smooth and plumb.
 - 4. Using a brush, roller or spray equipment, apply a coat of Color Prime over the dry base coat and allow to dry.
 - 5. Apply the specified Elastomeric DPR - Limestone finish coat in accordance with Dryvit's printed installation instructions.
- C. Honeycomb surfaces (building 400):
 - 1. Apply two continuous layers of Genesis DM Base Coat over the existing substrate to fill voids and provide a smooth, level base for the system. Allow to dry between applications.
 - 2. Using a brush, roller or spray equipment, apply a coat of Color Prime over the dry base coat and allow to dry.
 - 3. Apply the specified Elastomeric DPR - Limestone finish coat in accordance with Dryvit's printed installation instructions.

3.4 FIELD QUALITY CONTROL

- A. The contractor shall be responsible for the proper application of the Dryvit TAFS.

- B. If required, the contractor shall certify in writing the quality of work performed relative to the substrate system, details, installation procedures, workmanship and as to the specific products used.

3.5 CLEANING

- A. All excess materials shall be removed from the job site by the contractor and disposed of properly.
- B. All surrounding areas, where Dryvit TAFS have been installed, shall be left free of debris and foreign substances resulting from the contractor's work.

3.6 PROTECTION

- A. Dryvit TAFS shall be protected from weather and other sources of damage until dry.

END OF SECTION 09 96 00

EPOXY FLOOR COATING

SECTION 09 96 56

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section specifies epoxy floor coating (EPXY) for floors and wall bases.

1.02 SUBMITTALS:

- A. Comply with pertinent provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's technical data and application instructions.
- C. Samples: Prior to beginning work submit 3 samples for review of color and texture.

1.03 QUALITY ASSURANCE:

- A. Applicator Qualifications: Engage an experienced applicator trained and approved by the manufacturer.

1.04 PROJECT CONDITIONS:

- A. Application Temperature: Do not apply material when wither the substrate or the material is outside the temperature limits required by the manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

- A. Subject to compliance with requirements, provide products of the following, or approved equal:

- 1. Stonhard, Richmond, CA (510) 231-8930.

2.02 MATERIALS:

- A. System:
 - 1. Concession Room: Stonshield UTS.
 - 2. Restrooms: Stonshield HRI
- B. Color: As selected by Architect.

2.03 PERFORMANCE REQUIREMENTS:

A. Performance Properties – Stonshield UTS & Stonclad UT:

CHARACTERISTIC	PERFORMANCE	TEST METHODS
Compression	7,700 psi	ASTM C-579
Tensile Strength	1,000 psi	ASTM C-307
Flexural Strength	2,400 psi	ASTM C-580
Hardness	80-84	ASTM D2240
Bond Strength	>400 (100%) (Concrete failure)	ASTM D-4541
Abrasion Resistance	0.05 grams	ASTM D4060
Flammability (UT only)	Self Extinguishing	ASTM D-635
Thermal Coefficient of Linear Expansion	1.1 x 10 ⁻⁵ in.	ASTM E-831
Water Absorption	0.056%	ASTM C-413
Heat Resistance	200° F continuous 250° F intermittent	

B. Performance Properties – Stonshield HR1:

CHARACTERISTIC	PERFORMANCE	TEST METHODS
Compression	10,000	ASTM C-579
Tensile Strength	2,000 psi	ASTM C-307
Flexural Strength	4,300 psi	ASTM C-580
Hardness	85-90	ASTM D2240
Indentation	None	MIL-D-3134
Bond Strength	>400 (100%) (Concrete failure)	ACI 503/PP
Abrasion Resistance	0.06 grams	ASTM D 4060
Water Absorption	0.1%	ASTM C-413
Flammability	Self Extinguishing	ASTM D-635
Heat Resistance	140° F continuous 200° F intermittent	

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Prepare concrete by mechanical means including use of scabbler, scarifier or shot blast machine for surface removal.
- B. All surfaces shall be surface dry and free of dirt, dust, grease, oil, wax, paints, or other foreign material which could cause loss of adhesion.

3.02 APPLICATION:

- A. Surface Priming: Prime all properly prepared substrates using appropriate manufacturer's penetrating primers with strict adherence to installation instructions.

- B. Install epoxy floor coatings following manufacturer's written instructions and directions.
- C. Where epoxy floor coatings occur under kitchen equipment, provide a smooth finish. All other areas exposed to foot traffic, provide slip-resistant finish.
- D. Chasing: All areas where the installed coating does not abut against a vertical surface shall be chased. Cut chase 1-1/2-inch wide chiseled to a straight saw-cut 1/2 -inch depth.
- E. Cove Bases: Where scheduled, install cove integral with the floor in height indicated & 3/8" minimum radius cove. All coves with manufacturer's specially design cove strip.
- F. Expansion and Control Joints: Where indicated saw-cut joints after floor installation and fill with manufacturer's flexible epoxy or urethane sealant. Flooring joint locations to match joints in concrete.

3.03 CLEANING:

- A. Clean-up: At the end of each work day, remove rubbish, empty cans, rags and other discarded materials from the site.

3.04 PROTECTION:

- A. Protect work of other trades against damage from coating application. Correct damage by cleaning, repairing, and replacing, as acceptable to the Architect. Leave in an undamaged condition.
- B. Protect newly-applied coating with 2-layers of non-staining protection paper taped in place with duct tape. Tape first layer of Fortifiber Corp. "Seekure" floor protection sheet or similar heavy duty kraft paper. Tape a second layer of regular kraft paper over first layer. Tape all seams.

END OF SECTION

SECTION 10 11 16

MARKERBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Dry-wipe markerboards and edge trim.

1.02 RELATED SECTIONS

- A. None.

1.03 SUBMITTALS

- A. Manufacturer's product data.
- B. Sample of markerboard with chalk tray and map rail. Sample shall show edge treatment.
- C. Installation and maintenance instructions.

PART 2 - PRODUCTS

2.01 MARKERBOARD

- A. Liquid chalk dry-wipe Markerboards by Claridge
 - 1. LCS Deluxe, 5/8" face trim with map rail, 24 gauge LCS face with 1/2" Duracore core, and .015 Aluminum Sheet backing, or equal.
 - 2. Horizontal Sliding Units as shown on the drawings.
- B. Sizes per the drawings. Color shall be as selected by the Architect from manufacturer's standards. If not called out, use 5' x 8'.
- C. Edges to be trimmed with aluminum ends & casings.
- D. Substitutions will be evaluated per Spec Section 01 25 00 – Substitution Procedures.

2.02 ACCESSORIES

- A. Chalk/Marker tray with RL closures: No. 262 already included
- B. Flag Holder
- C. Metal Map Hooks already included

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that vinyl tackboard installation is complete prior to application of markerboard.

3.02 INSTALLATION

- A. Apply markerboard over vinyl tackboard in strict compliance with manufacturer's instructions and approved if tackboard is present or part of this project.

3.03 CLEAN UP

- A. Remove any visible adhesive from tackboard and adjacent surfaces. Clean all markerboards surfaces.

END OF SECTION

**SECTION 10 11 23
TACKBOARD**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Vinyl covered tackboard and edge trim.

1.02 REFERENCES

- A. CBC 11B-308 Reach ranges.

1.03 SUBMITTALS

- A. Manufacturer's product data.
- B. Sample of tackboard with selected vinyl covering in color and pattern selected. Sample shall show wrapped beveled edge.
- C. Installation and maintenance instructions.

PART 2 - PRODUCTS

2.01 TACKBOARD

- A. Vinyl covered fiberboard tackboard, 1/2 inch thick with wrapped beveled edges in long (vertical) dimensions, Domtar Gypsum, or equal. Vinyl shall be Koroseal RCV School Collection and Highlander, Type II, 18 oz. or equal. Color and pattern shall be as selected by the Architect.
- B. Cellulose fiber insulating base boards shall meet or exceed the physical requirements of ASTM C208 and FS LLL-I-53B, Class A.
- C. Finished vinyl surface shall have a Class III Flame Spread Index when tested in accordance with ASTM E84 and California Building Code Chapter 8. Smoke density shall be no greater than 450 when tested in accordance with CBC 2022 in the way intended for use.

2.02 ACCESSORIES

- A. Trim Moulding: Extruded plastic, covered on exposed surfaces with standard vinyl to match tackboard. Trim shall include top, bottom and end caps, inside and outside corners where required.
- B. Adhesive shall be as recommended by tackboard manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that gypsum wallboard substrate has been completed with all joints taped and fastener depressions filled.

3.02 INSTALLATION

- A. Apply tackboard to substrate with adhesive in strict compliance with manufacturer's instructions.
- B. Vertical joints in the field shall have wrapped beveled edges but tightly with joints plumb.

3.03 CLEAN UP

- A. Remove any visible adhesive from tackboard and adjacent surfaces. Clean all tackboard surfaces.

END OF SECTION 10 11 23

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.01 MANUFACTURER

- A. Basis of Design: Inpro Corporation (or approved equal)

1.02 REFERENCES

- A. Requirements in Addenda, Alternates, Conditions and Division 01 collectively apply to this work.

1.03 DESCRIPTION

- A. Principal Work Items Are:

- 1. Acrylic Signs:

- a. Room identification signs
 - b. Door signs
 - c. Accessible symbol signs
 - d. Exit signs, unlighted
 - e. Directional signs
 - f. Room capacity

- 2. Dimensional Letters:

- a. Building and area identification

- B. Related Work Specified Elsewhere:

- 1. Supporting construction: Respective Sections
 - 2. Installation of finish hardware and room identification signs: Section 06 10 00 – Rough Carpentry
 - 3. Section 09 91 23 - Painting

1.04 SUBSTITUTION

- A. Only written approval of the District will permit substitutions for materials specified. Refer to Section 01 25 00 – Substitution Procedures for procedures.

1.05 QUALITY ASSURANCE

- A. Uniformity of Manufacturer: For each separate type of sign required, obtain signs from one source from a single manufacturer.
- B. Requirements of Regulatory Agencies; Codes:

1. Division of the State Architect.
2. California Building Code (CBC Chapter 11B Div. 7) and Standards.
3. Conform to State Disability Requirements for standard Accessibility sign.
4. Field Inspection for compliance after installation.

- C. Inspection: Tactile signs shall be field inspected for compliance after installation (11B-703.1.1.2)

1.06 SUBMITTALS

- A. Comply with the General Conditions – Submittal Procedures
- B. Product Data: Submit manufacturer's technical data and installation instructions for each type of sign required.
- C. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
1. Samples for initial selection of color, pattern and texture.
 - a. Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
 2. Samples for verification of color, pattern and texture selected and compliance with requirements indicated:
 - a. Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
 - b. Dimensional Letters: Provide full size representative samples of each dimensional letter type required, showing letter style, color and material finish and method of attachment.
- D. Shop Drawings: Submit shop drawings for fabrication and erection of signs. Include plans, elevations and large scale details of sign wording and lettering layout. Show anchorages and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.
- E. Furnish full size spacing templates for individually mounted letters.

1.07 JOB CONDITIONS

- A. Sequencing Scheduling
1. General: Verify type of supporting construction; provide suitable attachments.
 2. Room Identification Signs: Coordinate with Finish Hardware as follows:
 - a. Verify available types of finish hardware for doors.

- b. Obtain templates.

PART 2 - PRODUCTS

2.01 PLASTIC SIGNS – All rooms receive sign at door(s) entering that room that has name of room and room number (as shown on drawing):

A. Type Imagery

1. Type style: Helvetica Medium, all upper case.
 - a. Raised Letter Size: Typical: 1" high, 1/8" thick.
 - b. Raised Number Size: Typical: 1-1/2" high, 1/8" thick.
 - c. All signage shall have raised text and grade II Braille, 1/16" stainless steel beads.
 - d. Other Sizes: As specifically indicated.
2. Arrangement: Use standard spacing between letters, words, numbers and lines; center text typically.

B. Symbol Style; General: Recognized standard "International Symbols of Accessibility", such as those developed by the American Institute of Graphics for the U.S. Department of Transportation.

C. Materials:

1. Sign Material:
 - a. Type: Cast acrylic, abrasion resistant, non-reflective face.
 - b. Thickness: 1/4".
 - c. If sign is adhered to glass, an equal sized acrylic backing plate shall be adhered to the back side of the glass opposite of the sign
2. Adhesive: Pressure sensitive, hi-tack transfer tape with peel-back paper backing.
3. Mounting Screws: Non-corrosive, tamper proof screws. Match finishes to the door hardware for the door where the signs are mounted.
4. Integral colors selected by Architect.

2.02 TOILET ROOM SIGNS

A. Symbols:

1. Accessible Symbols:
 - a. Symbols: to be selected.
 - b. Background: to be selected.
2. Male and Female Symbols:

- a. Symbols: to be selected.
 - b. Background: to be selected.
3. Boys and Girls Symbols.
- a. Symbols: to be selected.
 - b. Background: to be selected

2.03 PLASTIC ACCESSIBLE SYMBOL SIGNS:

- A. General: Conform to Paragraph 2.01 (except as indicated) and to the State Accessibility Code.
- B. Figure Symbols:
 - 1. Building Entrance Signs, at Main Entrance to every building:
 - a. Size: 6" x 6", typically.
 - b. Refer to drawings for locations.
- C. Geometric Symbols:
 - 1. Toilet Rooms:
 - a. For Men/Boys: An equilateral triangle, 12" on a side; 1/4" thick.
 - b. For Women/Girls: A 12" diameter circle; 1/4" thick.
 - c. For Both Sexes: An equilateral triangle, 12" on a side, superimposed over a 12" diameter circle; 1/4" thick.
 - 2. Edges and vertical requirements shall comply with 11B-703.7.2.6.4.

2.04 DIMENSIONAL LETTERS AND NUMBERS

- A. Cast Letters and Numbers: Form individual letters and numbers by casting. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Cast lugs into the back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.
 - 1. Metal: Aluminum.
 - 2. Letter Style: Impact (case & size as indicated on drawings).
- B. Paint Finish: Factory applied polyester powder coating system. Color to match Construction Manager's sample.
- C. Manufacturer: One of the following or approved equal:
LaHaye Bronze
Matthews International Corp.
Metal Arts
Metalic Arts, Inc.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Layout: Accurately lay out work to maintain proper lines, levels and spacing.

3.02 INSTALLATION; PLASTIC SIGNS

- A. General: Press tape firmly to mounting surface, and secure each plaque or sign with two screws.
- B. Signs Mounted on Doors:
 - 1. Mount following signs or plaques on room doors.
 - a. Toilet Rooms: Accessible geometric symbol signs.
 - 2. Accessible Geometric Symbol Signs at Toilet Rooms: Mount with center line of sign 60" above finished floor.
- C. Signs Adjacent to Doors: Mount on wall adjacent to door per the Drawings. Mount with expansion screws.
- D. Signs Mounted on glass:
 - 1. A similar, backing plate of the exact size, color and shape of the sign shall be used on the same side of glass directly behind where the sign is mounted. Sign to be adhered with adhesive strips per manufacturer recommendations.

3.03 INSTALLATION, DIMENSIONAL LETTERS AND NUMBERS

- A. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.

3.04 CLEANING AND PROTECTION

- A. At completion of installation, clean soiled sign surfaces in accordance with manufacturer's instructions. Protect units from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 14 16

PLAQUES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes plaques.

1.02 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For plaques.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show plaque mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each plaque full scale.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Plaque Schedule: Use same designations specified or indicated on Drawings or in a plaque or sign schedule.
- E. Sample warranty.
- F. Maintenance data.
- G. Location: Verified on Field during construction.

1.03 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PLAQUES, GENERAL

- A. Regional Materials: Plaques shall be manufactured within 500 miles of Project site.

2.02 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.03 PLAQUES

- A. Cast Plaque: Plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or to be supplied by the Architect at a later date during construction:
 2. Provide and install, where shown on the Drawings, one (1) cast bronze building plaque as manufactured by W-N-ART BRONZE COMPANY, 4325 N. Harrison Avenue, Fresno, California 93704. phone (559 269-4867) Building plaque shall be cast of pre-alloyed bronze ingot. Casting shall be dimensionally correct within normal tolerances and free from weakening defects of any character. Border and letters shall be raised and hand chased straight and true.
 3. Building plaque shall be 24" x 18" with Helvetica Medium letter style in capitals and lower case. Border shall be single line and background shall be stipple (pebble) texture. Mounting shall be by bosses and studs. Building plaque shall be chrome plated to provide mirror polish finish on border and letters. Sides of letters and borders shall be hand finished with background texture prior to plating process to ensure contrast.
 4. Coordinate related work, materials and mounting locations. Submit full size drawings incorporating copy provided by the Architect for approval. Submit rubbings of plaque patterns to the Architect for approval of layout and verification of copy prior to castings.

2.04 MATERIALS

- A. Bronze Castings: Lead-free alloy

2.05 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

4. Plaque Mounting Fasteners:

- a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque, unless otherwise indicated.
- b. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.

2.06 FABRICATION

- A. General: Provide manufacturer's standard plaques according to requirements indicated.
 1. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 3. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
 4. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.
 1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
 1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
 2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.

4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
- C. Remove temporary protective coverings and strippable films as plaques are installed.

END OF SECTION 10 14 16

SECTION 10 17 00

TOILET PARTITIONS - SOLID COLOR REINFORCED COMPOSITE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included: Provide all toilet partitions and urinal screens, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.
- B. Related Work Included in Other Sections:
 - 1. Toilet Accessories (Section 10 80 00)

1.02 QUALITY ASSURANCE

- A. Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.
- B. Qualifications of Installers: use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. Product Data: Within 30 calendar days after award of the Contract, submit:
 - 1. Complete materials list of all items proposed to be furnished and installed under this Section.
 - 2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
 - 3. Shop Drawings and sufficient dimensional data to enable proper coordination of installation of concealed items of support.
 - 4. Manufacturer's recommended installation procedures.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials of this Section before, during, and after installation and to protect work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the review of the Architect and at no additional cost to the Owner.

1.05 PERFORMANCE REQUIREMENTS

- A. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance in accordance with Section 9, "Graffiti Removal Procedure Using Manual Solvent Rubs":
 - 1. Cleanability: Five (5) required staining agents shall be cleaned off material.
- B. Scratch Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2197-98(2002) Standard Test Method for Adhesion of Organic Coating by Scrape Adhesion, using Gardner Stock #PA-2197/ST pointed stylus attachment on scrape tester:
 - 1. Scratch Resistance: Maximum Load Value shall exceed 10 kilograms.
- C. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2794-93(1999)e1 Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation (Impact), using .625" hemispherical indenter with 2-lb impact weight:
 - 1. Impact Resistance: Maximum Impact Force value shall exceed 30 inch-lbs.
- D. Fire Resistance: Partition material shall comply with the following requirements, when tested in accordance with ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:
 - 1. Smoke Developed Index: Not to exceed 450.
 - 2. Flame Spread Index: Not to exceed 75.
 - 3. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA): Class B.
 - b. International Code Council (ICC): Class B.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Model numbers for toilet partitions manufactured by Bobrick Washroom Equipment, Inc., Sierra Series, are listed to establish a standard of quality for design, function, materials, workmanship, and appearance. Other manufacturers may be submitted for evaluation by the architect by following the conditions of the substitution's clause. Unless approval is obtained ten days prior to the bid date, all bids shall be based on the standard of quality. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

Substitutions: Scranton Products - Hiny Hiders or equal

- B. Toilet partitions shall be the product(s) of a single manufacturer.

2.02 MOUNTING CONFIGURATIONS

- A. Toilet Partitions/Shower Dividers/Dressing Compartments shall be:

- 1. Overhead-Braced (1092 Sierra™ Series)
- 2. Approved Equal

- B. Urinal Screens shall be:

- 1. Post to Ceiling (1093 Sierra Series):
- 2. Approved Equal

2.03 COMPONENTS/MATERIALS

- A. Stiles, Panels, Doors, and Screens

- 1. Stiles, Panels, Doors, and Screens shall be all be manufactured from Solid Color Reinforced Composite material.
- 2. Accessibility Requirements
 - a. Accessible compartment door size to have clear width of 32" for end- opening compartment and 34" for side opening compartments.
 - b. Toe clearance at accessible compartments shall be 9" minimum A.F.F. and 6" deep minimum beyond the compartment side face of the partition.

- B. Toilet Partition Material

- 1. Toilet partitions shall be constructed of Solid Color Reinforced Composite material, which is composed of dyes, organic fibrous material, and polycarbonate/phenolic resins. Material shall have a non-ghosting, graffiti-resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface.

- C. Finish Thickness

- 1. Stiles and doors shall be 3/4" (19 mm).
- 2. Panels and benches shall be 1/2" (13 mm).

- D. Hardware

- 1. All hardware to be 18-8, type-304 stainless steel with satin finish.
- 2. Hardware of chrome-plated "Zamak", aluminum, or extruded plastic is unacceptable.
- 3. Hardware height at accessible compartments shall be mounted at 34" minimum, 44" maximum A.F.F. above finished floor.
- 4. Provide pulls on both sides of accessible compartment doors.

E. Latch

1. Sliding door latch shall be 14 gauge (2 mm) and shall slide on nylon track.
2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.
3. Latch track shall be attached to door by machine screws into factory-installed threaded brass inserts.
4. Threaded brass inserts shall be factory installed for door hinge and latch connections and shall withstand a direct pull exceeding 1,500 lbs. per insert.
5. Through bolted, stainless steel, pin-in-head Torx sex bolt fasteners shall be used at latch keeper-to-stile connections and shall withstand direct pull force exceeding 1,500 lbs. per fastener.

F. Hinges

1. Cam shall be adjustable in the field to permit door to be fully closed or partially open when compartment is unoccupied.
2. Hinges shall be attached to door and stile by theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts.
3. Fasteners secured directly into the core are not acceptable.
4. Door shall be furnished with two 11-gauge (3-mm) stainless steel door stop plates with attached rubber bumpers to resist door from being kicked in/out beyond stile.
5. Door stops and hinges shall be secured with stainless steel, pin-in-head Torx machine screws into threaded brass inserts.
6. Threaded brass inserts shall withstand a direct pull force exceeding 1,500 lbs per insert.
7. Self-closing hinges at door of accessible stall.

G. Coat Hook

1. Coat Hook shall be constructed of stainless steel and shall project no more than 1-1/8" (29 mm) from face of door.
2. Coat hook shall be secured by to door by through-bolted, theft-resistant, pin-in-head Torx stainless steel screws. Through-bolted fasteners shall withstand a direct pull force exceeding 1,500 lbs. per fastener.

H. Mounting Brackets

1. Mounting Brackets shall be constructed of stainless steel and shall be mounted inside compartment.
2. Fasteners at locations connecting panels-to-stiles shall utilize through bolted, stainless steel, pin-in-head Torx sex bolt fasteners. Through-bolted fasteners shall withstand direct pull force exceeding 1,500 lbs. per fastener.
3. Wall mounted urinal screen brackets shall be 11 gauge (3 mm) double thickness.

- I. Leveling Device shall be 7-gauge, 3/16" (5-mm) hot rolled steel bar; chromate-treated and zinc-plated; through-bolted to base of solid color reinforced composite stile.
- J. Stile Shoe shall be one-piece, 4" (102-mm) high, type-304, 22-gauge (0.8-mm) stainless steel with satin finish. Top shall have 90° return to stile. Shoe will be composed of one-piece of stainless steel and capable of being fastened (by clip) to stiles starting at wall line.
- K. Headrail (Overhead Braced) shall be satin finish, extruded anodized aluminum (.125" / 3-mm thick) with anti-grip profile.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Check area schedules to receive partitions for correct dimensions, plumbness of walls and soundness of surfaces that would affect installation of holding brackets.
- B. Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.
- C. Do not begin installation of partitions until conditions are satisfactory.

3.02 ERECTION

- A. General:
 - 1. Install partition rigidly, straight, plumb, and level.
 - 2. Installation methods shall conform to manufacturer's recommendations for backing and proper support.
 - 3. Conceal evidence of drilling, cutting, and fitting to room finish.
- B. Overhead Braced partitions:
 - 1. Attach stile to supporting floor, anchored with minimum 2 in. (50mm) penetration into supporting floor system.
 - 2. Level, plumb, and tighten installation.
 - 3. Secure stile shoes in position.
 - 4. Set tops of doors parallel with over head brace when doors are in closed position.

3.03 ADJUST AND CLEAN

- A. Adjust hardware for proper operation after installation.
- B. Set hinges on inward swing doors to hold doors open approximately 15 degrees from closed position when unlatched.
- C. Set hinges on inswing and outward swing doors for accessible compartments to

hold doors in closed position when unlatched.

- D. Clean exposed surfaces of partitions, hardware, fittings, and accessories.

END OF SECTION

SECTION 10 26 13

CORNER GUARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Stainless Steel Corner Guards.

1.02 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's product data.
- C. Samples: Submit for approval 12" long sample of each color specified.
- D. Test Reports: Submit manufacturer's test reports and certification indicating compliance with applicable building code requirements.

1.03 QUALITY ASSURANCE

- A. Comply with specified project requirements regarding fit and finish.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in a clean, dry location protected against damage of any kind.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Koroseal Wall Protection Systems or approved equal.

2.02 CORNER GUARDS

- A. Koroseal "Korogard" Series GS20: 48" long x 16-gauge Stainless Steel Corner Guard adhered or screwed to substrate corner. Exposed surfaces shall be free of discoloration or other imperfections or approved equal.

- 1. Dimensions

- a. Leg length: 2" - GS20
- b. Angle: 90° (Custom Angle Available).

2. Material: Stainless Steel, type 304.
3. Finish: #4 Satin.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify by examination that wall surfaces are acceptable to receive the specified guard systems. Notify the Architect in writing if wall surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install corner guards to wall securely using mastic construction adhesive or appropriate screws, as specified.
- B. Install corner guards accurately in location, alignment, and elevation.

END OF SECTION

SECTION 10 28 13.13
ELECTRIC HAND DRYERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Warm air, high speed, and energy efficient self-contained electric hand dryers.
- B. Warm air, self-contained electric hair dryers.

1.02 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry.
- B. Section 26 05 00 - Common Work Results for Electrical.

1.03 REFERENCES

- A. ICC/ANSI A117.1 - American National Standard for Accessible and Useable Buildings and Facilities; 1998.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 32 00 – Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Operating instructions and performance.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Shop Drawings showing dimensions, method of attachment, and required supports.
- D. Electrical wiring diagrams for connection of hand dryers.
- E. Warranty for review by Architect.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing electric hand dryers with 10 years minimum experience.
- B. Equipment certified by Underwriters Laboratory, Inc., with UL and ULC labels.

- C. Comply with ICC/ANSI A117.1.

1.06 WARRANTY

- A. Provide manufacturer's standard limited warranty for period specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Excel Dryer Inc., which is located at: 357 Chestnut St. P. O. Box 365; East Longmeadow, MA 01028; Tel: 413-525-4531; Email: request info (sales@exceldryer.com); Web: www.exceldryer.com.
- B. Substitutions: Dyson, Saniflow Corp. or equal.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 – Substitution Procedures.

2.02 ELECTRIC HAND DRYERS

- A. Hand Dryer: Warm air, rapid drying, energy efficient electric hand dryer; XLERATOR; surface mounted; entire dryer internally grounded.
 - 1. Warranty Period: 5 years; limited warranty.
 - 2. Made in the USA.
 - 3. Controls: Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed, or in 35 seconds if hands not removed. Control assembly completely sealed for protection against moisture, lint-dust and vandalism.
 - 4. Cover: One piece, vandal resistant, reinforced white thermoplastic (Bulk Molding Compound).
 - 5. Air Intake: Inlet openings on bottom of cover.
 - 6. Air Outlet: Delivers focused air stream of 18,000 LFM at nozzle and 16,000 LFM at average hand position of 4 inches (102 mm) below air outlet.
 - 7. Noise Reduction Nozzle: Reduces air deflection noise level by 9 db.
 - 8. Recess Kit: ADA compliant recess kit is fabricated of 22 GA 18-8 type 304 stainless steel with #4 satin finish with 16 GA 18-8 type 304 stainless steel dryer mounting plate. All welded construction. 16-3/8 inches (416 mm) wide by 26 inches (660 mm) high by 3-3/8 inches (86 mm) deep.
 - 9. Nominal Size: 11-3/4 inches (298 mm) wide by 12-11/16 inches (322 mm) high by 6-11/16 inches (170 mm) deep.
 - 10. Weight:
 - a. 17 pounds die cast cover.
 - b. 15 pounds stainless cover.
 - c. 13 pounds bulk mold compound.
 - 11. Power Source: 110/120 volt, 12.5 amp, 60 Hz.

12. Combination Motor and Blower: Series commutated, through-flow discharge, vacuum type; 5/8 HP, 20,000 RPM. Air flow rate: 19,000 linear feet per minute (97 meters per second) at air outlet, 16,000 linear feet per minute (81 meters per second) at average hand position of 4 inches (102 mm) below air outlet.
13. Heater: Nichrome wire element, mounted inside blower housing to be vandal proof.
14. Heater Safeguard: Automatic resetting thermostat to open when airflow is restricted and close when air flow is resumed.
15. Air Temperature: 135 degrees F measured at average hand position of 4 inches (102 mm) below air outlet. Air Heater Output: 900 watts.
16. All metal parts coated according to Underwriters Laboratories, Inc. requirements.
17. Mount dryers at heights indicated on Drawings.
18. Mount at the following heights above floor surface:
 - a. Men's Toilets: 45 inches.
 - b. Women's Toilets: 43 inches.
 - c. Toilets for Persons with Physical Disabilities: 37 inches.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Coordinate requirements for blocking to ensure adequate means for support and installation of hand dryers.
- D. Coordinate requirements for power supply, conduit, disconnect switches and wiring.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install dryers at specified heights.

- C. Install dryers securely to supporting substrate so that fixtures are level and aligned with each other. Use type and length of fastener as recommended by manufacturer for type of substrate.

3.04 PROTECTION

- A. Inspect installation to verify secure and proper mounting. Test each dryer to verify operation, control functions, and performance. Correct deficiencies.
- B. Protect installed driers until completion of project.
- C. Replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 44 13

FIRE EXTINGUISHER AND CABINETS

PART 1 - GENERAL

1.01 REFERENCE

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

1.02 DESCRIPTION

- A. Principal Work Items Are:
 - 1. Fire extinguishers
- B. Related Work Specified Elsewhere:
 - 1. Section 06 10 00 - Rough Carpentry.

1.03 SUBSTITUTIONS

- A. Only written approval of District will permit substitutions for materials specified. Refer to Section 01 25 00 – Substitution Procedures, for procedure.

1.04 SUBMITTALS

- A. Product Data: Four copies of manufacturer's printed data illustrating item and fully describing all features.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS

- A. Portable fire extinguishers:
 - 1. All classrooms, except as noted below, are: Amerex Model 500, Classification 2A10BC steel tank dry chemical.
 - 2. Computer office, computer classrooms, electrical and telephone rooms: Amerex Model 398 Classification 2A10BC steel tank, Halotron.
 - 3. Kitchen and Home Economics Lab: Amerex Model 462 Classification 40BC steel tank, dry chemical.
 - 4. All labs & lab prep rooms: Amerex Model 567, Classification 4A40BC steel tank, high hazard

2.02 CABINETS

- A. JL Industries Ambassador Series

1. Semi-Recessed, 1-hour rated at framed walls
2. Surface Mount at block walls
3. Tempered Glass

PART 3 - EXECUTION

3.01 GENERAL

- A. In addition to the number shown on the drawings, provide two extinguishers of each type to be located as directed by District, all in accordance with California Fire Codes.

3.02 INSTALLATION

- A. Install on wall brackets typical at each location shown.
- B. Extinguishers to be filled and tagged by a licensed serviceman; ready for use.

END OF SECTION

SECTION 10 51 13 METAL LOCKERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Conditions of Contract, including General and Supplementary Conditions and Division 01 Administration Sections, apply to this Division.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Knocked-down, quiet metal lockers.
 - 2. Knocked-down athletic lockers.
 - 3. Locker benches.
- B. Related Sections include the following:
 - 1. Section 03 30 00: Cast-in-Place Concrete.
 - 2. Section 05 50 00: Metal Fabrication.
 - 3. Section 09 67 23: Resinous Flooring.

1.3 DEFINITIONS

- A. Uncoated Steel Sheet Thicknesses: Indicated as the minimum thicknesses.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
- B. Shop Drawings - Include plans, elevations, sections, details, and attachments to other work:
 - 1. Show base, sloping tops, filler panels and other accessories.
 - 2. Include locker identification system.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Qualification Data: For Installer.
- E. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.
- F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.
- C. Regulatory Requirements - Where metal lockers are indicated to comply with accessibility requirements, comply with ADA Guidelines and the California Building Code Sections 11B-

225.2.1 and 11B-811:

1. Provide not less than 1 shelf located no higher than 48 inches (1372 mm) above the floor for side reach.
2. Provide 1 shelf located at bottom of locker no lower than 15 inches (230 mm) above the floor for side reach.
3. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf (22.2 N).
4. Provide decal indicating accessibility.

1.6 WARRANTY

- A. Special Warranty - Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period:
1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 2. Damage from deliberate destruction and vandalism is excluded.
 3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

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 products by one of the specified manufacturers.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS) Type B, suitable for exposed applications.
- B. Expanded Metal: ASTM F1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.
- C. Stainless-Steel Sheet: ASTM A666, Type 304.
- D. Extruded Aluminum: ASTM B221, alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
- E. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.
- F. Anchors - Select material, type, size, and finish required for secure anchorage to each substrate:
1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of

- exterior walls and elsewhere as required for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 KNOCKED-DOWN, QUIET METAL LOCKERS

- A. Products:
 1. **Lyon Workspace Products**
 2. Art Metal Products, Div. of Fort Knox Storage Co.
 3. Tennsco Corp.
 4. Republic Storage
- B. Locker Arrangement: As indicated in Metal Locker Schedule located at the end of Part 3.
- C. Body - Assembled by riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:
 1. Tops, Bottoms, and Intermediate Dividers: 0.0209 inch, with single bend at sides.
 2. Backs and Sides: 0.0209 inch thick, with full-height, double-flanged connections.
 3. Shelves: 0.0209 inch thick, with double bend at front and single bend at sides and back.
- D. Frames - Channel formed; fabricated from 0.0528-inch- (1.35-mm-) thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames. Retain subparagraph below if needed; cross frames between tiers are not offered by all manufacturers:
 1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical frame members.
 2. Frame Vents: Fabricate horizontal face frames with vents.
- E. Doors - One-piece; fabricated from 0.0528-inch- (1.35-mm-) thick, cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges:
 1. Doors less than 12 inches (305 mm) wide may be fabricated from 0.0428-inch- (1.1-mm) thick, cold-rolled steel sheet.
 2. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
 3. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet; welded to inner face of doors.
 4. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
 5. Door Style - Vented panel as follows:
 - a. Louvered Vents - Not less than:
 - 1) Six louver openings at top and bottom for single-tier.
 - 2) Three louver openings at top and bottom for double-tier.
 - 3) Two louver openings at top and bottom for multiple-tier lockers.
- F. Hinges - Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees:
 1. Hinges - Manufacturer's standard, steel continuous or knuckle type:
 - a. Knuckle Hinges: Steel, full loop, 5 or 7 knuckles, tight pin; minimum 2 inches (51 mm) high. Provide not less than 3 hinges for each door more than 42 inches (1067 mm) high.

- G. Recessed Door Handle and Latch - Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant:
 - 1. Multipoint Latching - Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic and prelocking:
 - a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with 3 latch hooks and doors less than 48 inches (1219 mm) high with 2 latch hooks; fabricated from minimum 0.0966-inch- (2.5-mm-) thick steel; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated with vinyl or nylon to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- H. Combination Padlocks: Key-controlled, three-number dialing combination locks; capable of five combination changes.
- I. Equipment - Equip each metal locker with identification plate and the following, unless otherwise indicated:
 - 1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
 - 2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
 - 3. Multiple-Tier Units: Two single-prong wall hooks.
 - 4. Coat Rods: In lieu of ceiling hook for metal lockers 18 inches (457 mm) deep or greater.
- J. Accessories:
 - 1. Continuous Sloping Tops - Fabricated from cold-rolled steel sheet, manufacturer's standard thickness, but not less than 0.0329 inch (0.85 mm) thick:
 - a. Closures: Vertical-end type.
 - b. Sloped top corner fillers, mitered.
 - 2. Recess Trim: Fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.
 - 3. Filler Panels: Fabricated from cold-rolled steel sheet, manufacturer's standard thickness, but not less than 0.0329 inch (0.85 mm) thick.
 - 4. Finished End Panels: Fabricated from 0.0209-inch- (0.55-mm-) thick, cold-rolled steel sheet.
- K. Finish - Baked enamel or powder coat:
 - 1. Color: As selected by Architect from manufacturer's full range.

2.4 KNOCKED-DOWN ATHLETIC LOCKERS

- A. Products are subject to compliance with requirements; provide one of the following available products that may be incorporated into the Work include, as indicated on drawings, but are not limited to, the following:
 - 1. **Lyon Workspace Products, LLC; Knocked Down Expanded Metal** (Basis of Design).
 - 2. ASI Storage Solutions Inc; Competitor.
 - 3. Hadrian Manufacturing Inc; Gladiator.
 - 4. List Industries Inc.
 - 5. Olympus Lockers & Storage Products, Inc; Apollo HDV Lockers.
 - 6. Republic Storage Systems Company; Heavy Duty Ventilated.
- B. Expanded-Metal Doors: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angle frame; with 0.090-inch

(2.28-mm) nominal-thickness, steel sheet lock panel backed by 0.060-inch (1.52-mm) nominal-thickness, steel sheet retainer welded to door frame.

- C. Body - Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - 1. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
 - 2. Backs: 0.048-inch (1.21-mm) nominal thickness.
 - 3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.
- D. Unperforated Sides: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
- E. Frames - Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.097-inch (2.45-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames:
 - 1. Cross Frames for Double-Tier Lockers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- F. Reinforced Bottoms: Structural channels, formed from 0.060-inch (1.52-mm) nominal-thickness steel sheet; welded to front and rear of side-panel frames.
- G. Hinges - Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees; self-closing:
 - 1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
 - 2. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.
 - 3. Hinges: Manufacturer's standard, steel, continuous or knuckle type.
- H. Recessed Door Handle and Latch - Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant:
 - 1. Multipoint Latching - Finger-lift latch control designed for use with built-in combination locks, built-in cylinder locks, or padlocks; positive automatic latching and prelocking:
 - a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- I. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latching mechanism consisting of steel rods or bars that engage locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.
- J. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

- K. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.
- L. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- M. Coat Rods: Manufacturer's standard.
- N. Continuous Zee Base: 4 inches (102 mm) high; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.
- O. Finish - Baked enamel or powder coat:
 - 1. Color: as selected by Architect from manufacturer's full range.

2.5 LOCKER BENCHES

- A. General: Provide locker benches fabricated by same manufacturer as metal lockers.
- B. Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 9-1/2 inches (240 mm) wide by 1-1/4 inches (32 mm) thick, with rounded corners and edges.
- C. ADA Bench tops standard 1-piece units with back 48 inch by 24 inch with 20 inch high back support:
 - 1. Laminated maple with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.
- D. Fixed Pedestals - Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, provide one of the following:
 - 1. Cast Iron: 1-1/2-inch- (38-mm-) diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.
 - 2. Tubular Steel: 1-1/4-inch- (32-mm-) diameter steel tubing, with 0.1265-inch- (3.2-mm-) thick steel flanges welded at top and base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.
 - 3. Color: As selected by Architect from manufacturer's full range.

2.6 FABRICATION

- A. General - Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch:
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.
- B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Knocked-Down Construction: Fabricate metal lockers for nominal assembly at Project site using nuts, bolts, screws, or rivets. Factory weld frame members together to form a rigid, one-piece assembly.
- D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

- E. Coat Rods: Fabricated from 3/4-inch- (19-mm-) diameter steel; chrome finished.
- F. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch (9 mm) high.
- G. Continuous Sloping Tops - Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers:
 - 1. Sloped top corner fillers, mitered.
- H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.
- I. Finished End Panels - Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers:
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.7 STEEL SHEET FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
- C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.
- D. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Field Measurements - Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:
 - 1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

3.2 COORDINATION

- A. Coordinate size and location of concrete bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

3.3 EXTRA MATERIALS

- A. Furnish extra materials described below, before construction begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
 - 1. Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than 5 units:
 - a. Locks.
 - b. Identification plates.
 - c. Hooks.

3.4 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work:
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 INSTALLATION

- A. General - Install level, plumb, and true; shim as required, using concealed shims:
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
 - 3. Anchor back-to-back metal lockers to floor.
- B. Knocked-Down Metal Lockers: Assemble knocked-down metal lockers with standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Equipment and Accessories - Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates:
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates:
 - a. Identify metal lockers with identification noted on shop drawing submittal.
 - b. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
 - 4. Attach filler panels with concealed fasteners. Locate fillers panels where indicated on Drawings.
 - 5. Attach sloping top units to metal lockers, with closures at exposed ends.
 - 6. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
- D. Fixed Locker Benches: Provide not less than 2 pedestals for each bench, uniformly spaced not more than 36 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.6 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

3.7 METAL LOCKER SCHEDULE

- A. Athletic Lockers:
 - 1. 2 tier and 6 tier configuration as indicated on drawings:
 - a. 2 and 6 tiers for a total of 72-inches high.
 - 2. Color: As selected by Architect from manufacturer's full range. Metal Wardrobe Locker:
- B. ADA lockers as indicated on drawings, 2 tier.
- C. Metal Staff Lockers.
 - 1. Locker Size:
 - a. 2 tiers for a total of 72-inches high.
 - 2. Color: As selected by Architect from manufacturer's full range.

END OF SECTION 10 51 13

SECTION 10 65 00

HIGH VELOCITY LOW SPEED FANS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The ceiling mounted, circulation fan shall be Big Ass Fans. The fan shall be the model scheduled with the capacities indicated. The fan shall be furnished with standard mounting hardware and variable speed controls as manufactured by Big Ass Fan Company. Connected to the fire alarm and EMS.

1.02 RELATED WORK

- A. Factory installation services are available through Big Ass Fans; consult the appropriate installation scope of work for more information. Installation of the fan, miscellaneous or structural metal work (if required), field electrical wiring, cable, conduit, fuses and disconnect switches other than those not addressed in the installation scope of work consulted, will be provided by others.

1.03 REFERENCES

- A. American National Standards Institute/Underwriters Laboratories (ANSI/UL) UL507 and CAN/CSA C.22.2 No. 113-08.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions including recommendations.
 - 2. Storage and handling requirements including recommendations.
 - 3. Provide cut sheets on each product specified showing power and mounting requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Providing sole source for design, engineering, manufacturing and warranty claims handling.
- B. Installer Qualifications: Installation services are available upon request by a factory installer. Any and all work varying from that as described through the installation guide will be outsourced. Installer trained by factory (preferred).

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's shipping carton.

- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 SITE 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.

PART 2 - PRODUCT

2.01 MANUFACTURER

- A. Delta T Corporation, dba Big Ass Fans, PO Box 11307, Lexington, Kentucky 40575. Phone (877) 244-3267. Fax (859) 233-0139. Website: www.bigassfans.com.
- B. Alternate manufacturers are MacroAir Technologies Inc., Rite-Hite, substitutions under the provisions of 01 25 00 - Substitution Procedures.

2.02 HIGH VOLUME, LOW SPEED FANS – BIG ASS FANS POWERFOIL X2.0 MODEL (8 FT.)

- A. Complete Unit:
 - 1. The entire fan assembly shall be ETL certified and built pursuant to the construction guidelines set forth by UL standard 507 and CSA standard 22.2. The fan shall be designed to move an effective amount of air for cooling and destratification in large industrial applications over an extended life. The fan and components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. The sound levels from the fan operating at maximum speed shall not exceed 55 dBA (measured 20' below the blades and 20' horizontally from the center of the fan). Fan must be connected to the fire alarm system and tied into the EMS.
- B. Airfoil System
 - 1. The fan shall be equipped with ten (10) Powerfoil airfoils of precision extruded aluminum alloy. The airfoils shall be connected by means of two (2) high strength locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel retainers. As an option, airfoils may be powder coated as specified by the architect or owner.
 - 2. The fan shall be equipped with ten (10) Powerfoil winglets on the end of the airfoils and ten (10) AirFences™ positioned on the airfoils at the optimum location for performance. AirFences are fixed aerodynamic devices applied along the airfoil to break up the air and redirect the fan's air velocity profile, contributing to a 28% improvement in coverage area.

The winglets and AirFences shall be molded of ABS plastic. The standard color of the winglets and AirFences shall be "Safety Yellow".

C. Motor:

1. The fan motor shall be an AC induction type inverter rated at 1725 RPM, 230/460 VAC, and 60 Hz for 3 ϕ and 1725 RPM, 208 VAC, and 60 Hz for 1 ϕ . The motor shall be totally enclosed, fan cooled (TEFC) with an IP42 NEMA classification. NEMA standard frames 56C shall be provided for ease of service. The motor shall be manufactured with a double baked Class F insulation and be capable of continuous operation in -30oF to 122oF (-34oC to 50oC) ambient conditions. As an option, motor may be colored as specified by the architect or owner. As an option, the architect or owner may upgrade to the "harsh environment package" which will include a motor with an IP55 NEMA classification. As part of the "harsh environment package, the onboard VFD enclosure is seal for weather-resistant operation.

D. Gearbox:

1. The fan gearbox shall be a NitroSeal™ Drive designed specifically for the Powerfoil X2.0. The gearbox shall include a high efficiency, hermetically sealed, nitrogen filled, offset helical gear reducer with two stage gearing, a 2-1/2" hollow output shaft, cast iron housing, double lip seals, high quality SKF Explorer Series bearings with crowned cages for optimal lubrication flow, and precision machined gearing to maintain backlash less than 11 arc-minutes over the life of the unit. Lubrication shall be high-grade, low foaming synthetic oil with extreme pressure additives and a wide temperature range.
2. The fan gearbox shall be equipped with a hollow shaft in which wiring, piping, etc can be routed below the fan. A non-rotating, junction box shall be provided at the base of the fan for installing optional features such as lights or cameras. The inclusion of the hollow shaft and non-rotating junction box shall be specified at the time of order. As an option, gearbox may be colored as specified by the architect or owner.

E. Mounting Post:

1. The fan shall be equipped with a no critical weld design, mounting post that provides a structural connection between the fan assembly and extension tube. The mounting post shall be 3" x 3" and powder coated for corrosion resistance and appearance. As an option, mounting post may be colored as specified by the architect or owner.

F. Hub:

1. The fan hub shall be made of laser cut aluminum for high strength and light weight. The hub shall consist of two (2) aluminum plates, ten (10) aluminum spars and one (1) aluminum spacer fastened with a pin and collar rivet system. The hub shall be secured to the output shaft of the gearbox by means of a steel flange interface. The hub shall incorporate

five (5) safety retaining clips made of 1/4" thick steel that shall restrain the hub/airfoil assembly.

G. Mounting System:

1. The fan mounting system shall be designed for quick and secure installation from a structural support beam. The mounting bracket shall be of welded construction using low carbon steel no less than 3/16" thick and be powder coated for appearance and resistance to corrosion. All mounting bolts shall be SAE Grade 8 or equivalent. As an option, the mounting bracket may be colored as specified by the architect or owner.

H. Safety Cable:

1. The fan shall be equipped with a safety cable that provides an additional means of securing the fan assembly to the building structure. The safety cable shall be 3/8" to 1/4" diameter and fabricated out of 7 x 19 stranded galvanized steel. The loops shall be secured with swaged Nicopress sleeves, pre-loaded and tested to 3,200 lbf.
2. Field construction of safety cables is not permitted.

I. Controller:

1. The onboard, fan controller shall be constructed using a Variable Speed Drive (VSD) that is pre-wired to the motor and factory programmed to minimize the starting and braking torques, for smooth and efficient operation. The controller shall be prewired to the motor using a short run of flexible conduit with a dedicated ground conductor to minimize electromagnetic interference (EMI) and radio frequency interference (RFI). An incoming power cord shall also be pre-wired to the controller with an NEMA L5-20P twist-lock plug and 15-ft cord for ease of installation. As an option, the architect or owner may upgrade to the "harsh environment package" which will include a seal for weather-resistant onboard VFD enclosure. As part of the "harsh environment package, the motor will have an IP55 NEMA classification.

J. Wall Control:

1. The fan shall be equipped with a wall mounted keypad or wall control providing 100% control of all fan functions. The wall control shall be a digital keypad device mounted within a cast zinc cover. The cover shall be capable of mounting to a standard wall box utilizing a supplied adapter plate. The wall control shall be equipped with touchpad controls and an LED display for controlling the fan's direction, operation, speed, and programming. Communication with the fan VSD and wall control shall be by a standard CAT-5 (or higher) ethernet cable. The wall control comes standard with 150-ft of factory-assembled CAT5 ethernet cable.
2. The wall control shall be equipped with a simple diagnostic program to identify faults in the system. Provisions shall be made for retrieving fan operation and diagnostic data (fault messages) through the remote wall device.

K. Fire Control Panel Integration

1. Powerfoil® X2.0 shall include a standard, power-on shutdown fire relay for seamless fire-control panel integration. The fire relay can be wired on or off in the field.

L. Warranty:

1. The manufacturer shall replace any products or components defective in material or workmanship, free of charge to the customer (including transportation charges within the USA, F.O.B. Lexington, KY), pursuant to the complete terms and conditions of the Big Ass Fans Non-Prorated Warranty in accordance to the following schedule:

a.	Airfoils	Lifetime (Parts)
b.	Hub	Lifetime (Parts)
c.	Motor	15 years (Parts) [†]
d.	Gearbox	15 years (Parts) [†]
e.	Controller	15 years (Parts) [†]
f.	All other fan components	15 years (Parts) [†]
g.	Labor	1 year ^{††}

[†] 15 year parts warranty only valid with factory installation, 7 year parts without factory installation.

^{††} All reasonable costs of repair or replacement will be paid or reimbursed provided customer obtains pre-approval; see full warranty for details.

2. Further information on the terms and conditions of the warranties can be found in the Installation Guide.

PART 3 - ANCILLARY

3.01 INSTALLATION

- A. The fan shall be mounted to an angle iron or I-beam structure. Consult the Installation Guide for acceptable I-beam width, and proper sizing and placement of angle iron for a span mount. Big Ass Fans recommends consultation with a structural engineer or installation methods outside the manufacturer's recommendation and a certification submitted prior to installation.
- B. To reduce the risk of injury to persons, the fan shall be installed so that the airfoils are at least 10-ft above the floor. The fan installation area shall be free of obstructions such as lights, cables, sprinklers or other building structures; with the airfoils at least 2-ft clear of all obstructions. The fan should not be installed where it will be continuously subjected to wind gusts or in close proximity to the outputs of HVAC systems or radiant heaters.

- C. If the fan is hung from an extension tube that measures 4-ft or longer, it may be necessary to provide guy cables or struts to limit potential lateral movement of the fan. Guys wires come standard with all fans having an extension tube greater than or equal to 4-ft. A stiffening strut braced against an additional beam may be required if there is a close clearance situation.
- D. The design criteria for the fan mounting system shall be capable of handling 300 ft·lbs of torque.
- E. The installation of HVLS fans in buildings equipped with sprinklers, including ESFR sprinklers, shall comply with the following:
 - 1. The maximum fan diameter shall be 24 ft.
 - 2. The HVLS fan shall be centered approximately between four adjacent sprinklers.
 - 3. The vertical clearance from the HVLS fan to the sprinkler deflector shall be a minimum of 3 ft.
 - 4. All HVLS fans shall be interlocked to shut down immediately upon receiving a waterflow signal from the alarm system in accordance with the requirements of NFPA 72.

3.02 WORKMANSHIP

- A. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.

3.03 DOCUMENTATION

- A. The manufacturer shall furnish a copy of all operating and maintenance instructions for the fan.

END OF SECTION

SECTION 10 80 00

TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 REFERENCE

- A. Requirements in Addenda, Alternates, Conditions, and Division 01 collectively apply to this work.

1.02 DESCRIPTION

- A. Principal Work Items Are.
 - 1. Grab bars.
 - 2. Mirrors.
 - 3. Toilet paper dispensers.
 - 4. Toilet seat cover dispensers.
 - 5. Paper towel dispensers.
 - 6. Soap dispensers.
 - 7. Sanitary napkin-tampon vendors and disposal.
 - 8. Shower seats.
 - 9. Baby changing station
- B. Related Work Specified Elsewhere:
 - 1. Section 10 28 13.13 – Electric Hand Dryers
 - 2. Division 22 - Plumbing

1.03 SUBSTITUTIONS

- A. Only written approval of the District will permit substitutions for materials specified. Refer to Section 01 25 00 – Substitution Procedures.

1.04 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Conform to State Handicapped Regulations.

1.05 JOB CONDITIONS

- A. Sequencing, Scheduling: Coordinate work with related work of other Sections. Verify types of backing prior to installation of items.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers and Products:

1. Bobrick Washroom Equipment, Inc., as a standard of quality.
2. Other Manufacturers:
 - a. American Dispenser Company.
 - b. Accessory Specialties.
 - c. Bradley. D. Hallmack.
 - d. Parker.
 - e. Watrous.
 - f. Georgia Pacific.
 - g. BayWest.
 - h. Saniflow Corp.

B. Retain "Manufacturers" Paragraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

2.02 ITEMS

1. Soap Dispenser: District Supplied, Contractor to install
2. Paper Towel Dispenser: District Supplied, Contractor to install
3. Toilet Paper Dispenser: District Supplied, Contractor to install
4. Seat Cover Dispenser: District Supplied, Contractor to install
- 5a. Grab bars: Bobrick B-490 x 42" (1 -1 /4" diameter).
- 5b. Grab bars: Bobrick B490 x 36" (1 -1 /4" diameter).
- 5c. Grab bars: Bobrick B-68137 (showers only).
- 6a. Mirrors: Bobrick B-1658 (Staff & Faculty restrooms only).
- 6b. Mirrors: Bobrick B-1556 1830.
- 7a. Recessed sanitary napkin-tampon vendor: Bobrick B-3706.
- 7b. Surface-mounted sanitary napkin-tampon vendor: Bobrick B-2706.
8. Folding shower seat: Bobrick B-5181 or B-5191 (as required).
9. Shower curtain rod: Bobrick B-6047 (length as required).
10. Mop and broom holder: Bobrick B-223 x 36" (four holders).
11. Electric hand dryers, refer to Spec Section 10 28 13.13 for staff
12. Electric hand dryers, student restrooms B-7128 110v
13. Baby changing station: Koala KB200 Horizontal Surface Mounted
14. Special needs changing table: Max-Ability Pressalit Care 3000. 75" length - Model #R8528021 Fixed height w/ safety rail
15. Heavy Duty Soap Dish and Bar: Bobrick B-4290
- 16a. Partition-mounted sanitary napkin disposal: Bobrick B-354.
- 16b. Surface-mounted sanitary napkin disposal: Bobrick B-270.

2.03 PLACEMENT LOCATIONS

A. At sink locations in the Concession and P.T. Room.

1. Soap dispensers:-#1

2. Paper towel dispensers-#2

B. Coaches Restrooms

1. Room 103, 126:

- a. Grab bars-#5a & #5b.
- b. Mirrors-#6a.
- c. Toilet tissue dispenser-#3
- d. Soap dispensers-#1
- e. Toilet seat cover dispenser-#4
- f. Hand dryer-#11

2. Single Stall Restrooms: 112, 113, 106

- a. Grab bars-#5a & #5b. (1 at each H.C. Stall)
- b. Mirrors-#6a. (1 at each sink)
- c. Toilet tissue dispenser-#3 (1 at each toilet)
- d. Soap dispensers-#1 (1 at each sink)
- e. Toilet seat cover dispenser-#4 (1 at each toilet)
- f. Hand dryer #11 (1)
- g. Sanitary napkin disposal #16a or 16b (one (1) per stall).
- h. Sanitary napkin-tampon vendor #7a or 7b. (1)

C. Team Restrooms

1. Men: 115

- a. Grab bars-#5a & #5b. (1 at each H.C. Stall)
- b. Mirrors-#6a. (1 at each sink)
- c. Paper towel dispenser-#2 (2 in each restroom)
- d. Toilet tissue dispenser-#3 (1 at each toilet)
- e. Soap dispensers-#1 (1 at each sink)
- f. Toilet seat cover dispenser-#4 (1 at each toilet)

2. Women: 117, 127

- a. Grab bars-#5a & #5b. (1 at each H.C. stall)
- b. Mirrors-#6a. (1 at each sink)
- c. Paper towel dispenser-#2. (2 at each restroom)
- d. Toilet tissue dispenser-#3 (1 at each toilet)
- e. Soap dispensers-#1 (1 at each sink)
- f. Toilet seat cover dispenser-#4 (1 at each toilet)
- g. Sanitary napkin disposal #16a or 16b (one at each toilet).
- h. Sanitary napkin-tampon vendor #7a or 7b. (1 per restroom)

D. Janitor Rooms

1. Mop and broom holder #10.

- E. Various Locations per drawings
 - 1. Baby changing station #13: Room 112 & 113
- F. Shower Areas
 - 1. Folding shower seat #8. (1 at each H.C. shower)
 - 2. Grab bars #4c. (1 at each H.C. stall)
 - 3. Shower curtain rod #9. (1 at each shower)
 - 4. Recessed soap dish #15 (1 at each shower)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Anchorage: Securely anchor all items into solid backing with manufacturer recommended suitable attachments, Phillips-head typical.
 - 2. Mounting Heights: Conform to handicapped requirements for each particular items installed in areas serving the handicapped. Refer to construction drawing.
- B. Toilet Accessory Schedule (refer to drawings):
 - 1. Install scheduled items at locations indicated on drawings. Use manufacturer recommended anchor plates.
 - 2. At toilet partitions, use Bobrick 258 Series anchor plates for single grab bar installations.
- C. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- D. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION

SECTION 11 40 00

FOOD SERVICE EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes: Foodservice equipment work as indicated on the drawings and by equipment schedule at the end of this section.
- B. Drawings, the provisions of the Agreement, the General Conditions, and the Division 1 specification sections apply to all work of this Section.
- C. Substitutions: Substitute products will be considered only under the terms and conditions of Division 1.
- D. Substitutions: Proposals for alternate products and methods for applications indicated may be considered by the Architect, subject to requirements of Division 1, system performance requirements and applicable PART 1 requirements of this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For foodservice facilities.
 - 1. Indicate locations of foodservice equipment and connections to utilities.
 - 2. Key equipment using same designations as indicated on drawings.
 - 3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
- B. Equipment Spec Books: Submit six spec books in hardcover binder. Insert spec sheets in order of list of kitchen equipment shown in written specifications and labeled with the appropriate item number. Highlight accessories and voltages as appropriate on the spec sheets. If factory spec sheets are not available, indicate relevant information (size, plumbing requirements, and electrical requirements)

on white sheet. Gather spec sheets from the Owner for Owner supplied equipment and insert in spec book.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Manuals: Submit three sets in hardcover binders with the project address and "Foodservice Operation & Maintenance Manuals" on the front and edge of binder. Include information from each piece of equipment with electrical or gas connections. Information should include operation instructions, cleaning and maintenance instructions, parts listing if available, list of service agencies (names, addresses and phone numbers) authorized to repair the equipment, voltage, gas type, refrigerant used, serial number and copies of the warranties. List should be sorted alphabetically by manufacturer.

1.5 QUALITY ASSURANCE

- A. Certify that all work and materials comply with Federal, State and Local laws, ordinances and regulations and is confirmed by the local inspector having jurisdiction.
- B. Work and materials must be in full accord and when appropriate, shall be listed with following agencies:
 - 1. Local Health Department
 - 2. National Sanitation Foundation (N.S.F.)
 - 3. Underwriters Laboratories (U.L.) and ETL equivalent.
 - 4. American Gas Association (A.G.A)
 - 5. N.F.P.A. - latest edition, for exhaust system.
- C. Qualifications
 - 1. Kitchen Equipment Contractor (KEC) and its sub-contractors to have at least five (5) years experience in this type of work. Upon request provide at least three references for jobs of similar size and content.
 - 2. Commercially manufactured equipment is not acceptable unless evidence is furnished that similar equipment has been operating successfully in a minimum of three (3) installations (excluding testing laboratories, field testing, or prototypes) for at least one (1) year.
 - 3. Commercially manufactured equipment will be reviewed based on submittal data provide on manufacturer's literature and/or manufacturer's shop drawings for prime alternate or substituted items. Failure of the equipment to meet the capacity, operation, size, utility and production as submitted will result in the rejection of the equipment regardless of disclaimers.
 - 4. Custom-fabricated equipment shall be manufactured by a foodservice equipment fabricator with a least five (5) years experience in this type of

work, who has the plant, personnel, and engineering facilities to properly design, detail and manufacture high quality foodservice equipment.

- D. Regulatory Requirements: Install equipment to comply with the following:
1. ASHAE 15, "Safety Code for Mechanical Refrigeration."
 2. NFPA 54, "National Fuel Gas Code."
 3. NFPA 70, "National Electrical Code."
 4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
- E. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.

1.6 WARRANTY

- A. All equipment shall be fully guaranteed against defects in workmanship and material for one (1) year after Owner's final acceptance. Refrigeration Compressors shall be fully guaranteed for five (5) years. All repairs and replacement shall be made without charge to the Owner. Guarantee period shall commence with the first usage of the equipment for the intended purpose after final acceptance.

1.7 START-UP DEMONSTRATION AND MANUALS

- A. Provide factory-trained personnel for start-up and demonstration of equipment. Demonstration shall be done in two stages: One for operation and the second for maintenance personnel.
- B. Return to the job site within 10 days for final adjustment and calibration of equipment.
- C. Furnish service parts manuals as well as maintenance manuals for all equipment provided.
- D. Prepare list of service agencies authorized by the manufacturer to service its equipment. Include the name of the person to contact and a telephone number.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS OF FABRICATION

- A. Fabrication shall conform to general acceptance of the foodservice industry.
- B. Fabrication shall meet or exceed National Sanitation Foundation standards including the latest editions and revisions.

2.2 MATERIALS

- A. Stainless Steel (S/S): Stainless steel shall be of U.S. Standard-gauges as indicated, but not less than 18-gauge or as noted, Type 304 with No. 4 finish.
- B. Galvanized Steel: Galvanized steel shall be of 14-gauge and shall be electro galvanized. Galvanized steel shall be used in non-exposed areas, areas which have not contact with food for food serving items, and in framework, when used in framework, galvanized steel shall be all welded construction.
- C. Plastic Laminate (PL):
 - 1. Shall be Formica, Parkwood, LamiArt, or approved equal.
 - 2. Shall be veneered with approved waterproof and heatproof cement. Rubber base adhesives are not acceptable.
 - 3. Shall be applied directly over 3/4" plywood.
 - 4. Exposed faces and edges shall be faced with 1/16" thick material. Corresponding backs shall be covered with approved backing and balancing sheet material.
- D. Solid Surface Material (SSM):
 - 1. Shall be Granite, Caesarstone, Silestone or approved equal and installed over 3/4" plywood or metal bases. Provide air space, trim, and/or insulation around any heat or cold producing equipment to guard against discoloration and cracking.

2.3 METAL TOP CONSTRUCTION

- A. Metal tops shall be one-piece 14-gauge welded construction, including field joints. Secure to a full perimeter galvanized steel channel frame cross-braced not farther than 30 inches on center. Fasten top with stud bolt or tack welds.

2.4 ENCLOSED CABINET BASES

- A. Bases shall be fabricated from not less than 18-gauge steel reinforced by forming the metal ends and shelves. Partitions shall be all stainless steel. The ends and vertical partitions may be of single wall construction, with a 2-inch face, all partitions and sides shall be welded in the intersection and flush with the bottom.
- B. Unexposed backs and structural members may be constructed of galvanized steel.
- C. Intermediate shelves shall be removable, except the bottom shelf when the cabinet is on legs. When the cabinets is on a masonry base, the bottom shelf shall be removable to all access for cleaning.

2.5 LEG AND CROSS RAILS

- A. Legs and cross railings shall be 1-5/8", 16-gauge stainless steel tubing. All cross rails shall be continuously welded, ground and polished. Tack welds or other methods of connection are not acceptable. Bottoms of legs shall be wedged inward and fitted with a stainless steel bullet type foot with not less than 2" adjustment. Freestanding legs shall be pegged to floor with 1/4" stainless steel rod.
- B. Stainless steel gussets shall be not less than 3" diameter at top and 3-3/4" long. Outer shell 16-gauge stainless steel reinforced with 12-gauge mild steel inserts welded interior shell. Gussets shall be large enough to accommodate 1-5/8" tube with provision for Allen screw fastener.
- C. Low counter legs shall be constructed of stainless steel exterior of 5-3/4" minimum height or 7" maximum height with 3-1/2" inch square plate with four countersunk holes, welded to top for fastening.
- D. Adjustable foot shall be constructed of stainless steel 1-1/2" diameter tapered at the bottom to 1" diameter, fitted with threaded cold rolled rod for minimum 1-1/2" by 3/4" threaded busing plug welded to legs.
- E. When legs are fastened to equipment, the following methods should be used:
 - 1. Sinks: Reinforced with bushing and set screws.
 - 2. Metal Top Table or Dishtable: Welded to galvanized steel frame of 14-gauge or more and secure to the top with screws through slotted holes.
 - 3. Wood or Composition Top: A welded stainless steel channel of not less than 14-gauge, secured to the top with screws through slotted holes.

2.6 SHELVES

- A. When shelves are part of the fixture, the following shall take place:
 - 1. Open base type shelf shall be notched around the leg and continuously welded to the leg.
 - 2. Cabinet base type shelf shall be turned up on the back side a minimum of 1/4" radius and further slightly to insure a tight fit to enclosure panels.
- B. Wall shelves shall be one-piece 16-gauge welded construction, including field joints. Secure to walls with 14-gauge s/s brackets at 36" on-center maximum spacing.
- C. Overshelves shall be one-piece 16-gauge welded construction, including field joints. Secure to 1" s/s tubular supports at 60" on-center maximum spacing attached to counter tops.

2.7 SINKS

- A. When multiple compartments are part of the design, they shall be continuous on the exterior without applied facing strips or panels. Bottom of each compartment shall be creased such as to ensure complete drainage to waste opening.
- B. Partitions between compartments shall be double thickness, continuous, and welded.
- C. Where sink bowls are exposed, the exterior shall be polished to a number 4 finish.
- D. Fabricator shall provide drains, wastes, and faucets as indicated on drawings, or itemized specifications.

2.8 OTHER FABRICATED COMPONENTS

- A. Casters:
 - 1. Shall be heavy-duty type, ball bearing, solid or disc wheel with non-marking greaseproof rubber, neoprene or polyurethane tire.
 - 2. Wheel shall be 5" diameter, minimum width of tread 1-1/2", with a minimum capacity per caster of 250 pounds.
 - 3. Solid material wheels shall be provided with stainless steel rotating wheel guards.
 - 4. Shall be sanitary, have sealed wheel and swivel bearing and polished plate finish.
- B. Doors:
 - 1. Metal doors shall be double cased stainless steel. Outer pans shall be 18-gauge stainless steel with corners welded, ground smooth, and polished. Inner pan shall be 20-gauge stainless steel fitted tightly into outer pan with a sound deadening material such as Celotex or Styrofoam used as a core. The two pans shall be tack welded together and joints solder filled. Doors shall finish approximately 3/4" thick and be fitted with flush recessed type stainless steel door pulls.
 - 2. Sliding doors shall be mounted on large, quiet ball bearing rollers in 14-gauge stainless steel overhead tracks and be removable with the use of tools. Bottom of cabinet shall have stainless steel guide pins and not channel tracks for doors.
 - 3. Wood doors shall be fabricated as detailed. If Formica or other plastic surfaces are used, all sides shall be laminated.
 - 4. Hinged doors shall be mounted on heavy-duty NSF approved hinges, or as noted on plans or specifications.

C. Hardware:

1. Shall be solid, heavy-duty type.
2. Door hardware shall be locking type, keyed and master keyed.
3. Shall be identified with manufacturer's name and number so that broken or worn parts may be replaced.
4. Submit samples for approval, when requested.
5. Pulls shall be Component Hardware or equal.

D. Drawer Assemblies:

1. Assemblies shall consist of removable drawer body mounted in a ball bearing slide assembly and padlock assembly.
2. Slide assembly consists of one pair of roller bearing extension slides with side and back enclosure panels, front space angle, two drawer carrier angles secured to slides and stainless steel front.
3. Slides shall be 250-pound capacity made by Component Hardware or equal.
4. Drawer bodies for general storage shall be 20" x 20" with Royalite containers.
5. Drawers intended to hold food products shall be removable type with 12" x 20" stainless steel food pan.
6. Drawer fronts are double case 3/4" thick, with 18-gauge stainless steel welded and polished front pan. Steel back pan is tightly fitted and tacked welded. Sound deadened with rigid insulation.
7. All drawers shall be provided with replaceable soft neoprene bumpers or, for refrigerated drawers, a full perimeter soft gasket.

2.9 FABRICATED WORKMANSHIP

- A. Items of specially fabricated equipment shall be fabricated by an acceptable manufacturer, which is NSF approved and fabricated in an approved manner to the complete satisfaction of the Owner.

1. Welding and Soldering:

- a. Materials 18-gauge or heavier shall be welded.
- b. Seams and joints shall be shop welded or soldered as the nature of the material may require.
- c. Welds shall be ground smooth and polished to match original finish.
- d. Where galvanizing has been burned off, the weld shall be cleaned and touched up with high-grade aluminum paint.

B. Fasteners and Joints:

1. The following shall not be accepted:

- a. Exposed screw or bolt heads.
 - b. Rivets.
 - c. Butt joints made by riveting straps under seams and then filled with solder.
- C. Rolled Edges: Rolled edges shall be as detailed, with corners bull nosed, ground and polished.
- D. Coved Corners: All stainless steel foodservice equipment shall have 1/2" or larger radius coves in all horizontal and vertical corners and intersections per NSF standards.
- E. Closures: Where ends of fixtures, backsplashes, shelves, etc. are open, fill by forming the metal, or weld sections, if necessary to close entire opening flush to walls or adjoining fixtures.

2.10 OPERATION REQUIREMENTS

- A. Insure quiet operation of foodservice and related equipment.
- B. Insure that bumper gaskets, stops, and any other needed protection is installed on all fabricated equipment as needed.

2.11 COLD STORAGE ROOMS. (Not Used)

2.12 REFRIGERATION SYSTEMS (Not Used)

2.13 EXHAUST HOODS

- A. All exhaust hoods shall be construction of stainless steel no less than 18-gauge, type 304. All exposed surfaces shall be a number 4 finish. See plans for size and location of ducts.
- B. All exhaust hoods shall be (UL) Underwriter's Listed under the category "Exhaust Hood with Damper", listed with NSF (National Sanitation Foundation), and in accordance with all recommendations of NFPA's Standard #96.
- C. Provide stainless steel enclosure panels to finished ceiling, adjacent walls, and spaces between hoods.
- D. Light fixtures are to be incandescent unless otherwise specified.
- E. Bottom of hood to be mounted at 80" above finished floor.

2.14 FIRE PROTECTION SYSTEM

- A. The fire protection system shall conform to NFPA 17A latest edition.
- B. Provide all surface appliance, hood, and duct protection nozzles.

- C. All exposed piping to be chrome plated or sleeved. Run unexposed wherever possible.
- D. Include manual pull station, location as shown on drawings.
- E. Provide mechanical fire-fuel gas shut off valve for equipment below hoods. Verify size with plumbing plans.
- F. Upon completion the system must be tested in the presence of the enforcing agency.

2.15 ENCLOSURES

- A. Provide and install enclosure panels secured or removable for any equipment that houses equipment with movable parts for access. Also, cover and provide protection for any exposed steam line or condensate line that may be within reach of operating personnel.

2.16 ELECTRICAL WORK - GENERAL REQUIREMENTS.

- A. Before ordering equipment, confirm with the serving electric utility, all pertinent electrical requirements such as actual voltages available, number of phases, and number of wire in the system. Coordinate also with any electrical service provided by other Divisions.
- B. Components and assemblies shall bear the UL, RU, or ETL label or be approved by the prevailing authority.
- C. Custom fabricated and standard refrigerator units shall be provided with vapor tight receptacles, shatterproof lams, and automatic switches. All wiring shall be concealed when possible.

2.17 INSERT PANS

- A. All cut-outs, openings, drawers, or equipment specified or detailed to hold stainless steel insert pans shall be provided with a full compliment of pans as follows:
 - 1. One stainless steel, 20-gauge minimum, solid insert pan for each space, sized per plans, details, or specifications.
 - 2. Where pan sizes are not indicated in plans, details, or specification, provide on full size pan for each opening.
 - 3. Provide maximum depth pan to suite application and space.
 - 4. Provide 18-gauge removable stainless steel adapter bars where applicable.

2.18 CORDS AND PLUGS

- A. Where cords and plugs are used, they shall comply with National Electrical Manufacturer's Association (N.E.M.A.) requirements.

2.19 WATER FILTERS

- A. Provide water filters on all icemakers, beverage equipment, and steamers.

PART 3 – EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

- A. No provisions are normally made for receipt or storage of any item delivered to the job site before commencement of installation. Contractor is solely responsible for the staging, delivery and safe-keeping of all equipment until turned over to the owner.
- B. Fabricated and commercially manufactured equipment (buy-outs) must be received and accounted for by the Contractor at his warehouse facilities until such time as placement is possible and acceptable by the GC.
- C. Clearly identify all items by item number and area prior to delivery to the job site.
- D. Under no circumstances shall any individual or agent of the owner, architectural, trades, maintenance or security companies be asked to sign for or receive goods, equipment or services on the job site. Items, parts, optional pieces, trim, or any goods provided under this contract are the responsibility of the contractor whether on the owner's property or in transit until the areas shown in these documents are handed over to the owner or owner's agents.

3.2 INSTALLATION

- A. Contractor shall supervise and direct his work using his best skill and attention. During the installation period, the Contractor shall provide a competent superintendent or foreman for such directions regarding connection, installation and coordination of all work under the contract.
- B. Contractor shall be solely responsible for all construction means, methods, techniques, procedures and coordination of all portions of his work under the contract and for coordinating the installations with the General Contractor, so as not to interfere with or delay the overall construction of the project.
- C. Contractor shall verify conditions at the building, particularly door openings, passages, and availability and size of elevators and avoid building any items too large for available openings. Contractor shall provide for the possible necessity of removing and replacing windows or wall panels. Any pieces too bulky for existing facilities shall be hoisted or otherwise handled with apparatus as required. All special handling equipment charges shall be paid by the Contractor.

- D. Floor troughs and drip pans shall be provided by Contractor and installed by the General Contractor. The Contractor shall provide a supervisor for the installation.
- E. Accurately set, scribe, square, level and permanently secure all items in precise position as indicated on drawings and shop drawings. Exercise extreme care to avoid damaging finished surfaces during the handling and erecting of all items. Repair, replace or otherwise make good all damaged surfaces or blemishes arising from installation in a manner approved by the Owner.
- F. Complete installation with required fastenings, clip angles, braces, anchors and other fittings as required to render the work rigid and secure. Secure wood items with screws or anchor to furring strips to permit removal.
- G. Caulk all items resting on concrete pads to eliminate crevices between item and pad.
- H. Shim level items without legs with stainless steel shims. Caulk watertight to eliminate crevices between item and mounting surfaces on floor.
- I. Seal spaces between all units and walls, ceilings, floors or fixed adjoining units against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material as suited to the nature of the equipment. Seal and smooth, (when not exposed to extreme heat) with General Electric Silicone Construction Sealant Series SE1200 in appropriate color. Width of joints sealed with silicone not to exceed 1/4".
- J. Contractor shall do all cutting and fitting on the equipment required by other contractors for access for their piping, conduit or utility access.
- K. Do not use any exposed bolts, nuts or screws other than those shown on shop drawings. Any additional and approved bolts, nuts or screws must be stainless steel.
- L. Protect equipment that has been delivered to the job site from damage. Counter and table tops to be covered with plywood, flakeboard or hardboard during the installation period.
- M. Upon completion of installation, clean and polish all surfaces of each item with appropriate materials. At this time, prepare to account to the consultant and Owner for quantities, locations and conditions of all items.
- N. Should any repairs be required due to the neglect of the other contractors, the repairs must be approved by owner before the work is performed. All extra charges must be approved and all repairs required must be noted in writing before work is performed, stipulating the price and by whom the extra expense is to be paid. In case the Contractor does not secure such extra order, the expense shall be borne by him. No cutting, notching, drilling or altering of any kind shall

be done to the building by the contractor without first obtaining permission from the GC, owner, or architect.

- O. Throughout the progress of the work, the Contractor shall keep the working area free from debris of all types and remove from premises all rubbish resulting from any work being done by him. At the completion of work, the Contractor shall leave the premises in a clean and finished condition.

3.3 START-UP AND DEMONSTRATION

- A. Provide factory-trained personnel for start-up and demonstration of equipment. Demonstration shall be done in two stages: One for operation and the second for maintenance personnel.
- B. Return to the job site within 10 days for final adjustment and calibration of equipment.

PART 4A – SCHEDULED EQUIPMENT – CONCESSION AREA

Furnish and set-in-place all equipment listed in accordance with Part 2 Products, Plans, and Details, and manufacturers' standard specifications with options as listed in each item. Any existing equipment to be picked up by KEC, delivered, and set-in-place. Coordinate with owner.

EQUIPMENT

ITEM E1: REACH-IN FREEZER QTY: 1
Manufacturer: Traulsen
Model: G23010-053

- 1. 3/4 HP.
- 2. 115/60/1.

ITEM E2: 420 LB ICE BIN QTY: 1
Manufacturer: MANITOWOC
Model: D-420

- 1. 115/60/1 Ice machine.
- 2. 208/230/60/1 Condensing Unit 1.5 HP.

ITEM E3: OPEN

ITEM E4: HAND SINK QTY: 1
Manufacturer: Advanced Tabco
Model: 7-PS-75

ITEM E5: WORK TABLE QTY: 1
Manufacturer: Advanced Tabco
Model: TSS-305

ITEM E6: GAS COMBI-STEAM QTY: 1
Manufacturer: Rational
Model: SCC/OMP 201

ITEM E7: WORK TABLE QTY: 1
Manufacturer: Aero Manuf
Model: 1 TSX - 30144

ITEM E8: WORK TABLES QTY: 2
Manufacturer: Aero Manuf
Model: 1 TSX - 30120

ITEM E9: EXHAUST HOOD QTY: 1

STORAGE=

ITEM S1: DRY STORAGE SHELVING QTY: 1 Lot

Manufacturer: Cambro
Model: Camshelving

1. To consist of the following shelving units, each unit to be equipped with seismic feet:
 (2) CPU44487480 24" x 48" x 72" high with four shelves;

END OF SECTION

SECTION 11 50 00

MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY AND SCOPE

A. Section includes:

1. Specialty items required for this Work as indicated on the Drawings, including the following: bike racks, skateboard racks, trash cans

B. Related Divisions:

1. Section 01 30 00 – Cast In Place Concrete

1.02 ACTION SUBMITTALS

A. Supply all equipment in accordance with this specification.

B. Submittals:

1. Manufacturer's Data: Submit manufacturer's data and installation instructions in accordance with Section 01 33 00 – Submittal Procedures. Provide data indicating compliance with ASHRAE Standard 110.1995.

PART 2 - PRODUCTS

2.01 SPECIALTY PRODUCTS (substitutions will be considered under the provisions of Section 01 25 00 – Substitution Procedures)

A. Bicycle Racks:

1. Belson Outdoors, 111 North River Road, North Aurora, IL 60542.
 - a. (2) Model BRG18-G (bike capacity 18 each)
 - b. Installation per manufacturer's instructions
 - c. Architect to locate before flatwork installed.

B. Trash Cans, each to have:

1. Belson Outdoors, 111 North River Road, North Aurora, IL 60542
 - a. (4) Model PFT34-D
 - b. Dome top lid Model R32DC
 - c. Color to be selected by Architect

- d. Installation per manufacturer's instructions

PART 3 - EXECUTION

3.01 SITE EXAMINATION

- A. The owner and/or his representative shall certify building conditions conducive to the installation of a finished goods product, including all critical dimensions.

3.02 INSTALLATION

- A. Preparation:

- 1. Prior to beginning installation check and verify that no irregularities exist that would affect quality of execution of work specified.

- B. Coordination:

- 1. Coordinate the work of the Section with the schedule and other requirements of other work being performed in the area at the same time both with regard to mechanical and electrical connections to and in the fume hoods and the general construction work.

- C. Adjust and Clean:

- 1. After installations are complete, adjust all moving parts for smooth operation.
 - 2. Remove all packing materials and debris resulting from this work, and turn over the fume hoods to the Owner clean and polished both inside and out.
 - 3. Repair or remove and replace defective work, as directed by owner and/or his representative upon completion of installation.

- D. Protection:

- 1. Provide reasonable protective measures to prevent casework and equipment from being exposed to other construction activity.
 - 2. Advise owner and/or his representative of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

END OF SECTION

SECTION 11 68 33 ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install track and field in-ground and other equipment.
- B. Furnish and install long jump pit sand, take-off boards, pit forms and pit covers.
- C. Furnish and install football goalposts.
- D. Related Sections
 - 1. Section 321313 – Site Concrete Improvements.

1.2 References

- A. National Federation of State High School Associations rule books.

1.3 Submittals

- A. Submit under provisions of Division 01 – Submittal Procedures.
- B. Product Data: Submit data indicating materials of construction, thicknesses/size, colors available, installation instructions.

1.4 Quality Assurance

- A. Install per manufacturer's specifications.
- B. Coordinate the equipment installations with other related work.

PART 2 - PRODUCTS

2.1 Materials

- A. Track And Field Equipment: Furnish and install the following track and field equipment as shown on the drawings. Approved manufactures are Gill Athletics, UCS, or approved equal. Gill Athletics model listed as standard of quality.
 - 1. Sand jump pit with sand catcher on two sides: Gill Athletics Model F44023. Jump pit cover F44023C.
 - 2. Take-off board: Gill Athletics 444S with blanking lid 44420
 - 3. Stainless steel vaulting box and lid: Gill Athletics 504/50401
 - 4. Shot put Ring: Gill Athletics Model 364 cast aluminum toeboard and model 373 white powder coated steel circle, 0-1/4" x 1-1/2", or equal.
 - 5. Discus Circle: Gill Athletics Model 371 flat powder coated steel circle.
 - 6. Discus Gage: Gill Athletics Model 8020 – seven aluminum poles with ground sleeves and 14' tall nylon net.
 - 7. Portable Timing Camera pole (1): Gill Athletics E39917.
- E. Long Jump Pit Sand Material:
 - 8. Long Jump Pit Sand Material – Long jump pit sand shall be washed river sand without any organic material or debris, and shall meet the following gradation: 0 –

2mm with a maximum of 5% less than 0.20mm per weight.

- F. Football Goalposts:
 - 9. Gooseneck football goal posts: Gill Athletics Model F362 plate mount, yellow powder coated goal post with 6.625" OD SCH 40 aluminum center post with an 8' offset and 4" diameter cross bar, and 20'-0" high 4" OD uprights with wind indicators, or equal. Upright opening shall be 23'-4" wide per NFHS rules.
 - 10. Goal post access kit: Gill Athletics F304S.

PART 3 - EXECUTION

3.1 Examination

- A. Verify site conditions.

3.2 Preparation

- A. Identify installation locations.
- G. Locate, identify, and protect existing above and below grade utilities from damage.
- H. Employ equipment and methods appropriate to the work site.

3.3 Installation

- A. Install and/or assemble per detailed drawings and in conformance with the manufacturer's installation instructions.

END OF SECTION 11 68 33

SECTION 13 34 16
PERMANENT GRANDSTANDS

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

- A. Provide labor, material, equipment, and supervision necessary to complete installation of permanent steel grandstand, including the following:
 - 1. Steel Substructure
 - 2. Decking System
 - 3. Concrete Foundations

1.02 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturers must have a minimum of ten years of experience in the manufacture of bleachers and grandstands; manufacturer must exhibit proof of business existence for past five years with documentation; welders must be AWS certified.
- B. Installer Qualifications: Experienced in the proper installation of grandstands.
- C. Source Quality Control: Mill Test Certification.

1.03 SUBMITTALS

- A. Manufacturer's Product Data: Submit manufacturer's descriptive product data for project.
- B. Shop Drawings: Manufacturer to submit shop drawings sealed by a California registered engineer and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the applicable code and relevant laws.
- C. Product Sample: Submit one 18-inch seat sample.
- D. Color Sample: If applicable, submit sample.

1.04 SITE CONDITIONS

- A. Field Site:
 - 1. Owner to make site accessible.
 - 2. Owner to verify site locations, benchmarks.
- B. Underground Utility Line: Owner to clearly mark all underground utilities and obstructions and Owner to relocate all that conflict with grandstand.
- C. Soil Test: Furnished by Owner.

1.05 BUILDING CODES

- A. Must meet or exceed all State and Local applicable codes and be in compliance with the current California Building Code, Title 24, and ICC 300.

1.06 WARRANTY

- A. Permanent Grandstand shall be under warranty for a period of one (1) year beginning at date of substantial completion for projects installed by manufacturer. The warranty will provide for repair or replacement of failed components due to defects in materials and workmanship of installation for the specified period. This warranty excludes any other defects resulting from abnormal use in service, vandalism, weathering, oxidation, accidental or intentional damage or any occurrences beyond the manufacturer's control.

1.07 MAINTENANCE

- A. Owner is to conduct annual inspection and required maintenance of grandstand to assure safe conditions. It is also recommended that a professional engineer or registered architect perform inspections biennially.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Per Approved Drawings:

- A. Southern Bleacher Company (800) 433-0912, or pre-approved equal
 - 1. Alternate manufacturers seeking to be pre-approved must submit product literature and references (with contact names/numbers) to the Owner 14 days prior to bid date for ten (10) DSA approved stadium projects of a similar size completed within the past two years.
 - 2. Each manufacturer must provide their own DSA approved drawings and structural calculations.
 - 3.. No time extensions to the schedule will be granted awaiting DSA approval and Liquidated Damages will apply as specified in Division 1.

2.02 PERMANENT STEEL GRANDSTAND

- A. Product Description
 - 1. **Football-Home:** Horizontal Beam Design
Gross seating capacity of 5139, net seating capacity of 4117 plus 50 wheelchair spaces, 27 rows, and 285'-6" long
Press Box: Site built and by others

Football-Visitors: Horizontal Beam Design
Gross seating capacity of 2329, net seating capacity of 1947 plus 26 wheelchair spaces, 17 rows, and 205' 6" long.
 - 2. Wide-flange construction for football grandstands.
 - 3. Traverse bays are free of cross bracing the total length of the grandstand.

4. Stringers are wide flange with steel angle rise and depth fabrication and are placed as required to meet design intent and structural requirements of the project.
5. Front Walkway:
 - a. Football:
 1. Width: 12' 5" on home side, 6' 5" on visitor side.
 2. Elevated: 12' 1" on home, 4' 6" on visitor side, above grade at the benchmark.
6. Entry stairs to be firmly anchored to uniformly poured concrete bases.
 - a. Stair rise: 7 inches maximum, with aluminum closure and contrasting aluminum stair nose.
 - b. Stair tread depth: 11 inches.
 - c. Guardrails: As required by code.
 - d. Stairs to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the nosing of treads and landings. Where handrails are not continuous between flights, the handrails shall extend horizontally at least 12 inches beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. Ends shall be returned or shall terminate in newel posts or safety terminals.
7. Aisles:
 - a. Aisles with seating on both sides to have discontinuous mid-aisle handrails. The handrails shall be discontinuous with breaks at intervals not to exceed five rows. These breaks shall have a clear width of at least 22 inches and not greater than 36 inches horizontally.
 - b. Anodized aluminum handrails with rounded ends to be provided with an intermediate handrail below the main handrail.
 - c. Aluminum tread nosing of contrasting color on aisle steps.
 - d. Half-steps shall be provided for riser heights above 8 inches.
 - e. Half-steps shall provide equal rise and run throughout aisle. Each shall have aisle nosing with non-skid black powder coated finish or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H and riser closure with clear anodized finish.
 - f. Aisles with a riser height of non-uniformity shall be indicated with distinctive markings as required by code.
8. Decking:
 - a. Rise and Tread Depth:
 1. Home and Visitor Stand- 12" with tread depth of 26"
 - b. Each seat 17 inches above its respective tread.
 - c. Mill Aluminum Decking Arrangement
 - (1) Tongue & Groove Deck System
 - d. Seating Selection
 - (1) Anodized Aluminum Bench Seat
 - (a) 2 x 10 (standard), Die #7758 with height of 1 1/2"

9. Guard railing: To be at all sides of bleacher, entry stairs and ramps, portals, and landings. Railing to be anodized aluminum with end plugs at ends of straight runs and/or elbows at corner. All guardrails shall be secured to angle rail risers by galvanized fasteners. Railing shall be at heights as required by code for its location on the grandstand. Guard railing shall include intermediate railing, or galvanized chain link fencing fastened in place with galvanized fasteners and aluminum ties.
 10. Ramps:
 - a. Slope: 1 in 12.5.
 - b. Guardrails: As required by code plus toe board.
 - c. Handrail: Ramps to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the ramp surface. Where handrails are not continuous between runs, the handrail shall extend horizontally above the landing 12 inches minimum beyond the top and bottom ramps. Ends shall be returned or shall terminate in newel posts or safety terminals.
 11. Handicap provision:
 - a. Quantity of wheelchair spaces: Per above and drawings
 - b. Riser area adjacent to wheelchair spaces to have closed intermediate construction.
 12. Front Facades:
 - a. Flat Dur-kyn finish riser board façade on front of home and visitor grandstand.
- B. Materials/Finishes
1. Substructures: Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
 - b. Shop connections are seal welds.
 - c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.
 - d. Painted steel finish is unacceptable.
 2. Extruded Aluminum:
 - a. Seat Planks, Backrests, Stanchions, Riser Planks, and Railing are extruded aluminum alloy, 6063-T6.
 - (1) Clear anodized 204R1, AA-M10C22A31, Class II finish for seat plank
 - (2) Factory applied, baked-on Kynar or Hylar/acrylic resin-based paint coating, Dur-Kyn, as manufactured by the Valspar Corporation for all riser boards fascades. Dur-Kyn meets or exceeds the physical and performance properties of AAMA 2603.
 - b. Tread planks are extruded aluminum alloy 6063-T6 mill finish.
 - c. Railing: Extruded aluminum alloy, 6063-T6 clear anodized 204R1, AA-M10C22A31, Class II.
 3. Accessories:
 - a. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.

- b. Hardware:
 - (1) Bolts, Nuts: Hot-dipped galvanized or mechanically galvanized.
 - (2) Hold-down Clip Assembly: Aluminum alloy 6005A-T6, mill finish.
 - (3) Structural Hardware: Equal to or greater than hot-dipped galvanized ASTM-A307. No connections utilizing high strength bolts are classed as slip critical.
 - d. Aisle Nose and Stair Nose: Aluminum alloy, 6063-T6, non-skid black powder coated finish or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H.
- C. Fabrication:
- 1. Design Load:
 - a. Tread and Seat Area: 100 psf uniform live load.
 - b. Seat (Vertical): 120 lbs/lf.
 - c. Seat (Horizontal Sway): 24 lbs/lf parallel and 10 lbs/lf perpendicular to seat.
 - d. Handrail and Guardrail: 50 lbs/lf in any direction.
 - e. Handrail and Guardrail: 200 lbs concentrated in any direction.
 - f. Snow Loads: As per State adopted code.
 - g. Wind Loads: As per State adopted code.
 - h. Seismic Loads: As per State adopted code.
 - 2. All manufactured connections to be shop welded.
 - a. Manufactured by certified welders conforming to AWS Standards.

2.03 PRESS BOX (SITE BUILT, BY OTHERS)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All work performed by technicians experienced in bleacher seating installation.
- B. Project as per approved shop drawings.

3.02 FIELD QUALITY CONTROL

- A. Foundation: Footings for the grandstand shall provide sufficient bearing area at bottom to support all loads of the grandstand. Depth and design of footings shall be determined by Owner supplied soil test. Hot-dipped galvanized anchor bolts shall be secured in the concrete footings. Concrete shall attain working strength of 3,000 psi.

3.03 CLEAN-UP

- A. Clean up all debris caused by work of this section.
- B. The Owner, Architect and Contractor acknowledge and accept that mill finish aluminum as specified may have water stains present from transportation and storage during installation. Removal of these stains is not part of this contract.
- C. Stand to be broom cleaned at completion.

SECTION 14 24 00 HYDRAULIC ELEVATORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Commercial, standard preengineered hydraulic passenger elevator.
 - 2. Elevator car enclosures, hoistway entrances and signal equipment.
 - 3. Equipment, machines, controls, systems and devices necessary for operation.
 - 4. Materials and accessories necessary to complete the elevator installation.
- B. Related Sections:
 - 1. Section 03 30 00: Cast-in-Place Concrete.
 - 2. Section 05 50 00: Metal Fabrications.
 - 3. Section 09 21 16: Gypsum Board Assemblies.

1.3 DEFINITIONS

- A. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
- B. Definitions in ASME A17.1 apply to work.
- C. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 SUBMITTALS

- A. Product Data: Technical data including capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.
- B. Shop Drawings - Submit plans, elevations, sections, and large scale details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment:
 - 1. Include large scale layout of car control station.
 - 2. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.
- C. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit, and machine room layout and dimensions, shown on Drawings, and electrical service, shown and specified, are adequate for elevator system being provided.
- D. Submittals:
 - 1. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
 - 2. Set of service tools.

3. Provide one electronic copy and two hard copies of manuals and inspection reports. Provide two complete printed sets of service, parts, schematic diagrams and adjustment manuals. Prints required by state code for each elevator.
 4. Provide four copies of independent service keys. Provide 4 factory cut keys for every lock on each elevator and label use. Provide two extra copies of the independent service key for a total of 6 keys.
 5. Final inspection by the state inspector shall have a School District representative present to observe. Complete the final documentation for the State Inspection and return to the School District Maintenance Department:
 - a. The Owner shall apply for the operation/inspection certificate provided by the State Inspector. Cost of the state inspection shall be paid by the elevator subcontractor/manufacturer.
- E. Operation and Maintenance Data: Submit for elevators to include in emergency, operation, and maintenance manuals and parts list, with recommended parts inventory.
- F. Inspection and Acceptance Certificates and Operating Permits: Required by authorities having jurisdiction for normal, unrestricted elevator use.
- G. Continuing Maintenance Proposal - Submit a continuing maintenance proposal from Installer to Owner, in the form of a two year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options. Maintenance agreement includes but is not limited to:
1. Systematic examination, adjustment, and lubrication of all elevator equipment.
 2. Repair or replacement of electrical and mechanical parts of the elevator installation as required, using only the genuine standard parts approved for the original installation.
 3. Maintenance work as required during regular working hours and regular working days, but with emergency callback service available at all times during this maintenance period.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Building Code: Comply with applicable provisions of the CBC and the Elevator Code.
 2. Elevator Standard: Comply with ASME A17.1.
 3. Fire Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.
 4. Accessibility Requirements - Comply with applicable requirements:
 - a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
 - b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
 - c. California Building Code 2022; Guidelines for Passenger Elevators.
- B. Manufacturer/Installer Qualifications - Elevator manufacturer having minimum 10 years documented experience who is trained and approved by manufacturer, including but not limited to:
1. Manufacturer of the power unit, controller, signal fixtures, door operators cab, entrances, and other major parts of the elevator operating equipment.
 2. Primary and major equipment components are manufactured in the United States and are not be an assembled system.
 3. Documented, ongoing quality assurance program.
- C. Source Limitations - Obtain elevators through one source from a single manufacturer:

1. Provide major elevator components, including pump and tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.
- D. Inspection and Testing - Elevator Installer shall obtain and pay for required inspections, tests, permits and fees for elevator installation:
 1. Arrange for inspections and make required tests.
 2. Deliver documentation to the Owner upon completion and acceptance of elevator work.

1.6 WARRANTY

- A. Written warranty signed by manufacturer in which manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period:
 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 2. Warranty Period: 2 year(s) from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Basis of Design – **Otis Gen3 Core**; subject to compliance with requirements, provide basis of design or comparable by one of the following:
 1. Otis Elevator ThyssenKrupp Elevator.
 2. Schindler Elevator Corporation
 3. Thyssen Krupp Elevator

2.2 FINISH MATERIALS

- A. Cold Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.
- B. Hot Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304.
- D. Textured Stainless Steel Sheet: ASTM A240/A240M, Type 304, with embossed texture rolled into exposed surface.
- E. Stainless Steel Bars: ASTM A276, Type 304.
- F. Stainless Steel Tubing: ASTM A554, Grade MT 304.
- G. Aluminum Extrusions: ASTM B221, Alloy 6063.
- H. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500 or No. C77600.

2.3 ELEVATOR SYSTEM

- A. Elevator System: Machine roomless, holeless hydraulic elevator system with standard components included in elevator systems necessary for complete system.
- B. Elevator Description:
 - 1. Rated Load: 3500 lb (1587 kg).
 - 2. Rated Speed: 110 fpm (0.51 m/s).
 - 3. Operation System: Single automatic operation.
 - 4. Car Enclosures:
 - a. Inside Width: Indicated on drawings.
 - b. Inside Depth: Indicated on drawings.
 - c. Inside Height: Indicated on drawings.
 - d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
 - e. Car Fixtures: Satin stainless steel, No. 4 finish.
 - f. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
 - g. Reveals: Black.
 - h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
 - i. Door Sills: Nickel silver.
 - j. Ceiling: Luminous ceiling.
 - k. Handrails: 1/2 inch by 2 inches (13 by 50 mm) rectangular, at rear of car.
 - l. Floor prepared to receive resilient flooring.
 - 5. Hoistway Entrances:
 - a. Width: 42 inches (1067 mm).
 - b. Height: 84 inches (2134 mm).
 - c. Type: Single speed center opening.
 - d. Frames: Satin stainless steel, No. 4 finish.
 - e. Doors: Satin stainless steel, No. 4 finish.
 - f. Sills: Nickel silver.
 - 6. Hall Fixtures: Satin stainless steel, No. 4 finish.
 - 7. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
 - b. Provide hooks for protective pads and one complete set of full height protective pads.
- C. Pump Units - Positive displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations:
 - 1. Pump shall be submersible type with submersible squirrel cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts.
 - 2. Motor shall have solid state starting.
 - 3. Motor shall have variable voltage, variable frequency control.
 - 4. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation absorbing material in blowout proof housing at pump unit.
 - 5. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
 - 6. Cylinder units shall be connected with dielectric couplings.
 - 7. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D1785, joined with PVC fittings complying with ASTM D2466 and solvent cement complying with ASTM D2564.
 - 8. Hydraulic Fluid: Nontoxic, biodegradable, **fire resistant** fluid, made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal passivating additives, that is approved by elevator manufacturer for use with elevator equipment.
 - 9. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work.

10. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1 of sufficient size to provide not less than 1 inch (25 mm) clearance from cylinder and extending above pit floor. Casing shall have means of monitoring effectiveness to comply with ASME A17.1.
 11. Corrosion Protective Filler: A nontoxic, petroleum based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler shall be electrically nonconductive, displace or absorb water, and gel or solidify at temperatures below 60 degrees F (16 degrees C).
- D. Car Frame and Platform: Welded steel units.
- E. Guides: Roller guides; provide guides at top and bottom of car frame.
- F. Operating Systems - Provide standard microprocessor operation system required to provide type of operation indicated:
1. Auxiliary Operations:
 - a. Single Car Standby Powered Lowering: On activation of standby power, car is lowered to the lowest floor, opens its doors, and shuts down.
 - b. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after 5 minutes and are re-energized before car doors open.
- G. Door Reopening Devices:
1. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
 2. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.4 CAR ENCLOSURES

- A. Provide steel framed car enclosures with nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation:
1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
- B. Materials and Finishes - Standards, but not less than the following:
1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8 inch (15.9 mm) nominal thickness.
 2. Stainless Steel Wall Panels: Flush, formed metal construction; fabricated from stainless steel sheet.
 3. Fabricate car with recesses and cutouts for signal equipment.
 4. Fabricate car door frame integrally with front wall of car.
 5. Stainless Steel Doors: Flush, hollow metal construction; fabricated from stainless steel sheet or by laminating stainless steel sheet to exposed faces and edges of enameled or powder coated steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 6. Sight Guards: Provide sight guards on car doors.
 7. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
 8. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
 9. Light Fixture Efficiency: Not less than 35 lumens/W.
 10. Ventilation Fan Efficiency: Not less than 3.0 cfm/W (1.4 L/s per W).

2.5 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies - Horizontal sliding, door and frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction:
 - 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire Rated Hoistway Entrance Assemblies - Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B:
 - 1. Fire Protection Rating: 1 hour with 30 minute temperature rise of 450 degrees F (250 degrees C).
- C. Materials and Fabrication - Standard, but not less than the following:
 - 1. Steel Subframes: Formed from cold or hot rolled steel sheet, with factory applied enamel or powder coat finish or rust resistant primer. Fabricate to receive applied finish as indicated.
 - 2. Stainless Steel Frames: Formed from stainless steel sheet.
 - 3. Stainless Steel Doors: Flush, hollow metal construction; fabricated from stainless steel sheet or by laminating stainless steel sheet to exposed faces and edges of enameled or powder coated steel doors using adhesive that fully bonds metal to metal without telegraphing or oil canning.
 - 4. Sight Guards: Provide sight guards on doors matching door edges.
 - 5. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
 - 6. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

2.6 SIGNAL EQUIPMENT

- A. Provide hall call and car call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal resistant buttons and lighted elements illuminated with LEDs.
- B. Car Control Stations - Provide recessed or semirecessed car control stations. Mount in return panel adjacent to car door unless otherwise indicated:
 - 1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 - 2. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two Way Telephone Communication Service: Provide flush mounted cabinet and required conductors in traveling cable for firefighters' two way telephone communication service.
- E. Car Position Indicator: Provide digital type car position indicator, located above car door or above car control station. Provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push Button Stations - Provide one hall push button station at each landing:

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
- G. Hall Lanterns - Units with illuminated arrows; however, provide single arrow at terminal landings. Provide the following:
1. Wall mounted units, for mounting above entrance frames.
- H. Hall Annunciator - With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down:
1. At manufacturer's option, audible signals may be placed on cars.
- I. Hall Position Indicators - Provide digital display type position indicators, located above hoistway entrance at ground floor:
1. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
 2. Integrate ground floor hall lanterns with hall position indicators.
- J. Standby Power Elevator Selector Switches: Provide switches, required by ASME A17.1, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.
- K. Fire Command Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), required by ASME A17.1, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.
- L. Emergency Pictorial Signs: Fabricate from materials matching hall push button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

PART 3 EXECUTION

3.1 COORDINATION

- A. Coordinate dimensions with structure, walls, and adjacent features.
- B. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- C. Furnish well casing and coordinate delivery with related excavation work.
- D. Coordinate locations and dimensions of other work specified that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

3.2 EXAMINATION

- A. Examine elevator areas for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

- B. Prepare written report listing conditions detrimental to performance of the work.
- C. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

- A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Install piping above the floor, where possible. Install underground piping in casing.
- E. Excavate for piping and backfill encased piping according to applicable requirements.
- F. Lubricate operating parts of systems recommended by manufacturers.
- G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- H. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and travel direction.
- I. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- J. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. Place hall lanterns either above or beside hoistway entrance.
 - 2. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.5 PROTECTION

- A. Temporary Use: Do not use elevator for construction purposes:

3.6 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator.
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.7 MAINTENANCE

- A. Initial Maintenance Service - Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies:
 - 1. Perform maintenance during normal working hours.
 - 2. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 14 24 00

SECTION 21 00 00

FIRE SPRINKLER SYSTEM

PART 1 GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 23 00 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

- A. General: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The entire building shall be fire sprinklered.
- B. Design/Calculations: The sprinkler system has been designed and sized by hydraulic calculations in accordance with 2022 NFPA No. 13 and fire authority requirements. Calculations have been included in submittals. Provide current fire flow information from flow test at nearest fire hydrant. Fire flow test shall be done within 6 months of installation of sprinkler system.
- C. Preparation of Drawings and Material Data Sheets: A complete fire sprinkler submittal (drawings, specifications, materials and hydraulic calculations) has been prepared. Hydraulic calculations shall conform to 2022 NFPA 13, paragraph 28.4.5 in all respects.
- D. Coordination Drawings: Contractor shall submit coordination drawings with Contractor title block to Engineer for review, in addition to materials submittals. Deviations between bid documents and coordination drawings shall be specifically noted on drawings (highlighted, clouded, etc.). Any contractor requested design changes to these documents, including layout, materials, or calculations, may be considered a substitution and shall comply with paragraph 1.4 below.

1.3 WORK SPECIFIED ELSEWHERE:

- A. Electrical wiring.
- B. Fire alarm system.
- C. Painting of exposed piping.

1.4 DESIGN CHANGES/SUBSTITUTIONS:

- A. General: Design changes or substitutions of fire sprinkler system shall be submitted to Engineer for review.
- B. Significant changes in design or substitution of materials may require a change order, requiring resubmission to DSA/FLS, as determined by the Engineer and/or DSA field engineer. Contractor shall bear all expenses incurred due to preparation and processing of design substitutions, up to and including submission to, and obtaining approval from, DSA/FLS. Refer to Section 23 00 00, 1.11, B, and DSA Policy PL 10-01 and Interpretation of Regulations IR A-6, available from <http://www.dsa.dgs.ca.gov>.

- C. Any substitution of "Flexible" type piping in lieu of "Rigid" pipe or any changes to size, manufacturer or lengths of "Flexible" type piping will require resubmittal of piping plans, product data sheets and hydraulic calculations to DSA/FLS for review and approval.
- D. Contractor shall submit design or field change(s) through proper channels. Engineer shall have a minimum of 5 working days after receipt of design or field change(s) to submit to DSA. Architect and Engineer shall not be liable for any delays due to DSA review time scheduling, or Contractor's failure to identify changed areas and/or substituted materials in shop drawings and submittals.

PART 2 - PRODUCTS

2.1 STANDARDS:

- A. All materials shall be in accordance with 2022 NFPA No.13 "Standard for the Installation of Sprinkler Systems". Underground mains shall be in accordance with 2019 NFPA No. 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances".

2.2 PIPING MATERIALS:

- A. General: The pressure rating of all piping, valves, flanges and other piping accessories shall be in accordance with code and fire authority requirements. Pressure ratings shall exceed the highest possible working pressure.
- B. Piping:
 - 1. Underground: Polyvinyl chloride, AWWA C900, with rubber ring joints, ASTM D1869, FM Class 200, DR14. Cast or ductile iron fittings, AWWA C110 or C153, Class 250 or higher, with rubber ring joints, ASTM D1869.
 - 2. Above Grade:
 - a. 2" and Smaller: Threaded black steel pipe, ASTM A53, schedule 40. 175 psi WOG (min.) black cast iron threaded fittings, ANSI B16.4, UL listed. Unions shall be Class 150 malleable iron threaded, ANSI B16.3.
 - b. 2-1/2" and Larger: Welded or grooved black steel pipe, ASTM A53, schedule 10. Standard weight carbon steel welding fittings, ANSI B16.9. Flanges shall be steel, ANSI B16.5. Roll grooved pipe couplings may be used for assembling welded sections, Victaulic, Grinnell, Gruvlok.
- C. Gate Valve:
 - 1. 2" and Smaller: All bronze, rising stem. UL listed.
 - 2. 2-1/2" and Larger: Iron body, bronze mounted, outside screw and yoke. UL listed. (UL listed butterfly valves may be substituted for 4" and larger gate valves above grade.)
- D. Check Valve:
 - 1. 2" and Smaller: All bronze swing check. UL listed.
 - 2. 2-1/2" and Larger: Iron body, bronze mounted swing check. UL listed.
- E. Drain Valve: All bronze angle globe valve. UL listed.
- F. Anchors and Hangers: Shall comply with 2022 NFPA No. 13.

2.3 SPRINKLER HEAD:

- A. Automatic sprinkler head, concealed type in areas with finished ceilings and recessed or suspended lighting, semi-recessed in areas with finished ceilings and surface lighting,

upright or pendent heads elsewhere (as allowed by NFPA 13). Heads in finished areas shall be Victaulic FireLock V38 quick response concealed, Tyco RFI quick response concealed, or Globe Fire Sprinkler Corp., Quick Response GL Series Concealed Pendent, with chrome-finish metal cover plate. Heads elsewhere shall be quick response, Victaulic FireLock V27, Tyco, Model TY-FRB or Globe Fire Sprinkler Corp., Model GL Quick Response, with standard finish. UL listed. Temperature ratings shall be in accordance with NFPA No. 13. Provide extra heads (of each type installed) in accordance with code requirements. Exposed heads installed with deflector lower than 7'-6" above floor shall have wire guards.

2.4 ALARM VALVE ASSEMBLY:

- A. Standard wet type alarm valve assembly complete with trim as required by the authority having jurisdiction. Provide flow switch and Electric Bell for connection to alarm system. Provide tamper switch. UL listed. Coordinate Electric Bell with Divisions 26 and 28.

2.5 POST INDICATOR VALVE:

- A. UL listed valve with lockable operating handle, tamper switch and target visible through a glass covered post, reading either "OPEN" or "SHUT".

PART 3 EXECUTION

3.1 PIPING INSTALLATION:

- A. General: Piping shall be concealed in walls, above the ceilings or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location shall be approved by the Architect. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. Depth of cover in traffic areas shall be 36 inches (minimum).
 - 1. Installer Certification: Installation shall be performed by certified fire sprinkler fitter(s) as required by CCR, Title 19, Divisions 1, Chapter 5.5. See CAL FIRE – Office of the State Fire Marshall Information Bulletin 17-002 for more information. The Bulletin can be downloaded from the following:
http://osfm.fire.ca.gov/informationbulletin/pdf/2017/IB_AESCert_final_05_25_17.pdf
- B. Standards: All piping shall be installed in accordance with NFPA No. 13 "Standard for the Installation of Sprinkler Systems". Underground mains shall be installed in accordance with NFPA No. 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances".
- C. Miscellaneous:
 - 1. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings or floors in finished areas.
 - 2. Pattern: Sprinklers shall be installed in a symmetrical pattern with lighting fixtures and with ceiling pattern. Heads located in lay-in ceilings shall be centered in panel, unless shown otherwise on drawings.
 - 3. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller and 2" annular clearance for piping 4" and larger.
 - 4. Access: Provide access doors as required for all valves, devices, etc.
 - 5. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding

the pipe, or pipe insulation sealed with fire rated materials in accordance with the requirements of 2022 CBC Section 714.

6. Concrete Thrust Blocks: Shall be constructed at all valves, tees, elbows, bends, crosses, reducers and dead ends in loose-joint pipe. Blocks shall cure a minimum of 7 days before pressure is applied. Concrete shall be 3000 psi mix.
7. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards, except where specifically allowed by CEC.

3.2 IDENTIFICATION:

- A. All controls, piping, valves and equipment shall be labeled for function and service in accordance with NFPA No. 13 and No. 24.

3.3 TESTS AND ADJUSTMENTS:

- A. Unless otherwise directed, tests shall be witnessed by a representative of the Architect and an inspector of the authority having jurisdiction. Contractor shall notify fire authority at least 48 hours prior to testing. At various stages and upon completion, the system must be tested in the presence of the enforcing agency. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and the entire work retested. Test all systems in accordance with fire authority requirements and NFPA No. 13 and No. 24.
- B. Backflow Preventer: All backflow preventers shall be tested according to manufacturer's recommendations and the USC Cross Connection Control and Hydraulic Research Manual (8th Edition). Testing shall be performed by an AWWA Certified Backflow Prevention Assembly Tester. Contractor shall certify in writing to the Architect the date which backflow preventers were tested and by whom test was witnessed.

3.4 CERTIFICATION:

- A. At completion of the project, a Contractor's Material and Test Certificate, indicating installation and testing in accordance with referenced standards, shall be completed. Copies shall be prepared by Contractor for the approving authorities, Owner and Contractor. Deliver certificates to Owner through Architect.

END OF SECTION 21 00 00

SECTION 22 00 00

PLUMBING

PART 1 GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 23 00 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
1. Sanitary sewer system.
 2. Domestic water system.
 3. Storm drain system.
 4. Fuel gas system.
 5. Drain system (including condensate drain).
 6. All equipment as shown or noted on the drawings or as specified.
 7. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, housekeeping pads, supports and related items no longer required.
 8. Lead Free: All equipment, fixtures, valves and fixture stops providing water for human consumption installed after January 1, 2010, must meet the "Lead Free" requirements for the State of California.
- B. Work Specified Elsewhere:
1. Line voltage power wiring, disconnect switches and installation of all starters are included in the Electrical Section unless otherwise noted.
 2. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
 3. Painting unless specifically called for in the drawings or specifications.
 4. Carpentry.
 5. Control of domestic hot water circulating pump.

PART 2 PRODUCTS

2.1 PIPING MATERIALS:

- A. Sanitary Sewer:
1. Soil, Waste and Vent Piping (Non-Pressurized):
 - a. Inside Building and Within Five Feet of Building Walls to Civil P.O.C.: Standard weight coated cast iron pipe and fittings. Plain end, CISPI 301, ASTM A888, or hub end with rubber gaskets, ASTM A74, ASTM C564. ABI, Tyler, Charlotte. Couplings shall be heavy-duty shielded couplings, Type 304 stainless steel, with neoprene gasket, ASTM C-1540. Husky HD 2000, Clamp-All 80, Mission HeavyWeight. MG Couplings are also acceptable. 2" and smaller exposed to view shall be galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12.

Fixture and equipment drains exposed to view in kitchens shall be DWV copper, recessed drainage fittings, 95-5 solder.

Where required by soil conditions, as determined by the method described in ASTM A74-09, Appendix X2, below grade cast iron pipe and fittings shall have 8 mil (minimum) Polyethylene Encasement (Poly Wrap), Per ANSI/AWWA C105/A21.5.

- b. Below Grade Coated at Kitchens and Snack Bars, Upstream of Grease Interceptor: Standard weight epoxy-coated cast iron pipe and fittings. Plain end, CISPI 301, ASTM A888. The inside of each pipe shall be reamed prior to coating to decrease the coefficient of friction. Pipe coating shall be chemically deposited zinc-phosphate pretreatment layer followed by an electrically deposited, high-performance cathodic epoxy coating, and finally an electrically deposited, high performance anodic epoxy top coat. Pipe and fitting coatings must pass the following performance specifications per EN 877: 350 hours of salt spray testing, resistance to wastewater for 30 days at 73° F, chemical resistance from pH 2 to pH 12 for 30 days at 73° F, resistance to hot water for 24 hours at 203° F. Cutting of piping and field coating of all cut joints shall be in accordance with the manufacturer's installation guidelines. Couplings shall be heavy-duty shielded couplings, Type 304 stainless steel, with neoprene gasket, ASTM C1540. Husky HD 2000. Charlotte Edge HP Iron.
 - 2. Cleanouts: Comparable models of Josam, Wade, Mifab or Zurn are acceptable. Grease plug prior to installation. Floor Cleanouts: Smith 4023 with nickel bronze top in finished areas; Smith 4223 in utility areas. Wall Cleanouts: Smith 4532 with stainless steel cover and screw. Pipe Cleanouts: Iron body with threaded brass plug. Site cleanouts more than 5' outside building may be PVC with PVC plug.
 - 3. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F8 in foot traffic areas; G5 in roadways. Provide with PVC pipe extension down to top of pipe.
- B. Storm Drain (Including Rain Water Leader, RWL) -Inside Building and Within Five Feet of Building Walls: Same as Soil, Waste and Vent Piping, except as otherwise noted on drawings. Where exposed to view on exterior of building, piping shall be galvanized steel with recessed drainage fittings.
- C. Water and Gas:
- 1. Hot and Cold Water Piping: Materials used in the water system, except valves and similar devices, shall be of like material, except where otherwise approved by Engineer and Authority Having Jurisdiction, prior to start of work. For existing water systems of galvanized steel or copper, materials shall match existing.
 - a. Inside Building, Within Five Feet of Building Walls to Civil P.O.C., and All Above Grade: Hard temper seamless copper, ASTM B88, Type L. Fittings shall be copper (1/2" to 2") or bronze (2-1/2" to 4") press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer's installation instructions. ProPress. Where space or items prohibit the installation of pressed fittings, wrought copper fittings, ANSI B16.22, with brazed joints (1100F, min.), may be used. 1-1/2" and smaller above grade may be soldered, lead-free solder. All nipples shall be lead-free red brass (85% copper).
 - 2. Gas Piping:
 - a. Inside Building and All Above Grade: 2" and Smaller: Schedule 40 galvanized steel pipe, ASTM A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. 2-1/2" through 4": May be screwed pipe as above or welded pipe as below. 6" and larger: Schedule

- 40 black steel pipe, ASTM A53. Standard weight carbon steel welding fittings, long radius ells, ANSI B16.9.
MegaPressG press connection fittings may be used for pipe sizes 1/2" - 4".
- b. Inside Building - Below Grade to Five Feet Outside Building: Same as Inside Building and All Above Grade. Provide sleeves (and vents as required by code) acceptable to administrative authority.
 - c. Outside Building - Below Grade: Polyethylene pipe and fittings, ANSI B31.8, ASTM D2513, where allowed by administrative authority, Driscopipe 6500, Dupont Aldyl "A", Plexco. Otherwise, piping shall be coated schedule 40 steel, ASTM A53.
3. Valves and Specialties:
- a. Valves:
 - (1) General: Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Kitz, Milwaukee, Nibco, Stockham, Walworth or Watts are acceptable. All valves of a particular type or for a particular service shall be by the same manufacturer. Use ball valves for 2" and smaller domestic water valves above grade. Butterfly valves may be substituted for 2-1/2" and larger gate valves above grade; see specification below.
 - (2) Gate Valve: 2" and Smaller: All bronze. Non-rising stem. Threaded bonnet. Wedge disk. Malleable iron handwheel. 200 psi CWP. Nibco T-113-LF. 2-1/2" and Larger: Iron body, bronze mounted. Non-rising stem. Resilient wedge disk. 200 psi CWP. Flanged or AWWA hub end as applicable. Nibco F-619-RWS. Underground valves shall have square operating nut.
 - (3) Butterfly Valve: Ductile iron threaded lug body. Aluminum bronze disk. EPDM molded-in liner and seals. 416 stainless steel shaft. 6" and smaller valves shall have multi-position lever handle. 8" and larger valves shall have gear operator. Provide 2" extension neck at insulated pipes. Nibco LD-2000.
 - (4) Ball Valve: Full port. Lead free brass body, cap, stem, disk and ball. Screwed connection. Lever handle. PTFE seat and stem packing. Min. 400 psi CWP. CSA-US and UL listed. Nibco T-FP-600A-LF.
 - (5) Check Valve: 2" and Smaller: Lead-free bronze swing check, regrinding. 200 psi CWP. Nibco T-413-Y-LF. For vertical applications use lead-free bronze, spring-loaded, lift-type. Nibco T-480-Y-LF. Check valves for air systems shall be the spring-loaded, quick-closing type, Stockham B-322-TS.
 - (6) Plug Valve: Valves in gas piping systems must be UL or CSA listed for gas distribution. 4" and Smaller: Eccentric bronze or nickel plated semi-steel plug. Semi-steel body. Bronze bushings. Buna-N-rings. 175 psi WOG. KeyPort Valve Series 400. 2" and smaller above grade may be listed full port ball valves, except in publicly accessible locations. Apollo, Jomar, Nibco.
 - (7) Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F8 in foot traffic areas; G5 in roadways. Provide with PVC pipe extension down to top of pipe.
 - b. Instruments:
 - (1) Thermometer: 3" dial. Stainless steel case. Back or bottom connected as required. 1/2" NPT. 20F-240F, 2F divisions for hot water. 25F-125F, 2F divisions for chilled water. 2" insertion length. Allowance to be made for insulation thickness. For installations over 7 feet above finish floor, provide digital thermometer with remote reader. Marshalltown, Moeller, Taylor, Tel Tru, Winters.

- (2) Thermometer Well: Brass well. Suitable for thermometer above. Provide 2" extension at insulated pipes.
- c. Miscellaneous Specialties:
 - (1) Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.
 - (2) Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Unions for copper piping shall be copper or lead free cast bronze. Anvil. Size 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. EPDM gasket, NSF 61 rated. Victaulic Style 77, Gruvlok.
 - (3) Dielectric Coupling: Insulating union or flange rated for 250 psig. Wilkins DUXL Series.
 - (4) Shock Absorber: Multiple bellows. All stainless steel construction. Designed and applied in accordance with PDI WH201. Amtrol, Smith, Wade, Zurn.
 - (5) Gas Pressure Reducing Valve: Capacity and pressure ratings as indicated on drawings. American Meter.
- D. Drain Piping (including Condensate): Same as inside building cold water piping.
 - 1. Condensate Drain Piping for Condensing Gas Fired Equipment: Solid wall schedule 40 CPVC piping with solvent weld fittings from equipment to neutralizing kit. Schedule 40 galvanized steel, ASTM A53 downstream of neutralizing kit. If no neutralizing kit, piping shall be CPVC to point of discharge.
- E. Flue and Intake Piping (Condensing Gas Fired Equipment): Schedule 40 CPVC piping with Schedule 40 CPVC solvent weld fittings. Install per equipment manufacturer's instructions.
- F. Miscellaneous Piping Items:
 - 1. Pipe Support:
 - a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Anvil, Unistrut.
 - b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco, Superstrut.
 - c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Anvil, Unistrut.
 - 2. Flashing: Vent flashing shall be 4 lb/ft² lead, 16" sq. flange, length sufficient to be turned down 2" into vent. Oatey. Flashing for other piping through roof shall be prefabricated galvanized steel roof jacks with 16" sq. flange. Provide clamp-on storm collar and seal water tight with mastic. For cold process built-up roof, material shall be 4 lb/ft² lead instead of galvanized steel. For single-ply roofing, use the roofing manufacturer's recommended flashing material.

2.2 PIPING INSULATION MATERIALS:

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

- B. Pre-Molded Fiberglass Heavy density sectional pre-molded fiberglass with vapor barrier laminated all service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft²-F at a mean temperature of 50F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping to 140°F, thickness shall be 1" for pipe sizes less than 1"; 1-1/2" thickness for pipe sizes 1" and 1-1/2"; 2" thickness for 2" and larger. See Title 24, Part 6 "California Energy Code" for temperatures above 140°F. Knauf, Johns-Manville, Owens-Corning.
- C. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft²-F at a mean temperature of 50F. 1-1/2" thickness. Knauf, Johns-Manville, Owens-Corning.
- D. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.
- E. Stretchable Glass Fabric: Reinforcing mesh. 10 X 20 continuous filament glass yarns per inch. Johns-Manville.
- F. Vapor Barrier Coating: Childers CP-30, Foster 30-25.
- G. Lagging Adhesive: Childers CP-50A, Foster 30-36.
- H. Aluminum Jacketing: Aluminum pipe and fitting jacketing. 0.016" thickness for straight pipe. 0.024" thickness for fittings. Stucco-embossed finish. Integral moisture barrier. Provide pre-fabricated aluminum strapping and seals by same manufacturer. Childers.
- I. Outdoor Mastic: Childers CP-10, Foster 65-05.
- J. Insulating Tape: Ground virgin cork and synthetic elastomeric. Black, odorless, and non-toxic. K factor 0.43 Btu-in/hr-ft²-F or less. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Halstead.
- K. Molded Closed Cell Vinyl (Piping Insulation Under Lavatories and Sinks): Fully molded closed cell vinyl, 1/8" thick, minimum. Thermal conductivity shall not exceed 1.17 BTU-in/hr-ft²-°F at an average temperature of 73°F. Weep hole in cleanout nut enclosure. Hinged cap over valve to allow access for servicing. Out of sight nylon fastening system and internal ribs on drain insulation to provide air gap (Lav-Guard Only). Truebro Lav-guard, McGuire Pro Wrap, Plumberex.

2.3 FIXTURES:

- A. General: Provide rough-in for and install all plumbing fixtures shown on drawings. Except in equipment rooms, all trim, valves and piping not concealed in wall structure, above ceiling or below floors, shall be brass with polished chrome plate finish, unless noted otherwise. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.
- B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures and trim. Manufacturer's model numbers are listed to complete description. Equivalent models of American Standard, Haws, Just, Kohler or Zurn are acceptable. For drainage fixtures, equivalent models of Josam, Mifab, Smith, Wade or Zurn are acceptable.
- C. Stops and P-Traps: All fixtures shall be provided with stops and P-Traps as applicable. Wall mounted faucets, valves, etc. shall have integral stops or wall mounted stops.

1. Stops: All hot and cold water supplies shall be 1/2" I.P.S. inlet angle stops with stuffing box, loose key, lock shield, and stainless-steel braided reinforced polymer tube with captive cone washers and heavy duty chrome plated brass nuts (3/8" for 2-1/2 gpm and less, otherwise 1/2"). ¼ turn ball stops do not require stuffing box. Dahl, McGuire, BrassCraft.
 2. P-Traps: Semi-cast brass, ground joint. 17-gage. Clean-out plug. Unobstructed waterway. California Tubular, McGuire.
- D. Caulking: Caulk fixtures with white G.E. "Sanitary SCS1700", mildew resistant silicone sealant with EPA listed anti-microbial.

2.4 EQUIPMENT:

- A. General Requirements:
1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
 3. Ratings:
 - a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut off, intermittent pilot ignition, and shall be CSA (US) or AGA certified.
 - b. Electrical: Electrical equipment shall be in accordance with NEMA standards and UL or ETL listed where applicable standards have been established
 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
 5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, and shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip-proof, NEMA B design on pumps, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction, unless otherwise noted. Design shall limit starting inrush current and running current to values shown on

drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Vertical motors with exposed fans shall have rain caps.

- d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
 - e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.
- B. Electric Drinking Fountain: Wall hung with bottle filler. Provide steel mounting brackets. Stainless steel basin. Removable grid drain. Chrome plated brass bubbler with automatic flow regulator and self closing valve. UL listed. ARI certified. Elkay.
- C. Water Heater: Natural gas fired. Minimum 92% thermal efficiency. Shall be design certified by CSA for 180°F application. Tank shall be lined with Vitraglas® vitreous enamel and shall have a bolted hand hole cleanout. Tank shall have four extruded magnesium anode rods installed in separate head couplings. Water heater shall be equipped with stainless steel cold water inlet, Hydrojet® Sediment Reduction System. Heater shall be insulated with Non-CFC foam. Water heater shall be equipped with an electronic ignition system, an ASME rated T&P relief valve and a premix closed combustion system for direct venting using either 3" or 4" CPVC vent pipe. Factory assembled and tested. Water heater shall be approved for zero inch clearance to combustibles. A digital LCD display shall be integrated into the front and be an adjustable electronic thermostat to any temperature up to 180°F. A recycling Energy Cut Off (E.C.O.) shuts off all gas in the event of an overheat condition. Certified at 300 PSI test pressure and 150 PSI working pressure. Design certified by CSA International, ANSI standard Z-21.10.3, for up to 180°F application as an Automatic Storage Heater. Neutralizing kit. Bradford White.
- D. Circulating Pump: In line centrifugal. 3-speed motor. Body: Lead Free bronze body, brass impeller. Mechanical seals. Bronze sleeve bearings. Integral thermal overload protection. Bell and Gossett/Xylem, Taco. -OR- Body: Aluminum housing. All parts exposed to fluid, stainless steel. Water lubricated ceramic shaft and bearings. Epoxy encapsulated windings. Grundfos.

2.5 GREASE INTERCEPTOR:

- A. Polyethylene grease interceptor designed and constructed in accordance with California Code of Regulations, Title 24. 24" manholes with gas tight cover. H20 rated. See schedule on drawings for tank sizing, inlet and outlet sizing and number of manholes. Schier..

PART 3 EXECUTION

3.1 PIPING INSTALLATION:

- A. General:
 - 1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall

be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted.

2. Joints:

- a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
- b. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
- c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
- d. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards.

3. Fittings and Valves:

- a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
- b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
- c. Unions: A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
- d. Valves: All valves shall be full line size. Provide shut-off valve for each building and each equipment connection. Provide shut-off valve at each point of connection to existing piping. At equipment connections, valves shall be full size of upstream piping, except that gas valves within 18" of the point of connection to the equipment may be the same size as the equipment connection.
- e. Valve Accessibility: All valves shall be located so that they are easily accessible. Valves located above ceilings shall be installed within 24" of the ceiling. For situations where this is not practical or where valves are greater than 10' above the floor, chain wheel operators shall be provided. Chain shall extend down to 7' above the floor. All such installations must have prior review by the Engineer.

4. Pipe Support:

- a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. Copper piping systems which protrude through a surface for connection to a fixture stop or other outlet shall be secured with a drop ell, Nibco 707-3-5, to a Holdrite Model #SB1 bracket; nipple through surface shall be threaded brass.

(1) Pressure Pipe:

Maximum Spacing*

Pipe Size (Inches)	Between Supports (ft.)		
	Copper	Sch. 40 steel	Plastic
1/2	6	6	4
3/4	6	8	4
1	6	8	4
1-1/4	6	10	4
1-1/2	6	10	4
2	10	10	4
2-1/2	10	10	4
3	10	10	4
4	10	10	4
6	10	10	4

*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings. Plastic piping shall be supported per the manufacturer's recommendations. Seismic requirements may reduce maximum spacing.

(2) Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.

- b. Hot and Cold Water Piping: All hot and cold water piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.
- c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.

5. Miscellaneous:

- a. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
- b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance.
- c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of 2022 CBC Section 714.
- d. Thermometer Tap: Provide tee for instrument well. Minimum size of pipe surrounding well shall be 1 1/2". Mount on side of pipe.
- e. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.

B. Sanitary Sewer Piping:

- 1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch. Bell and spigot piping shall be installed with barrel on sand bed; excavate hole for bell.
- 2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface.
- 3. Vents: Vents shall terminate not less than 6" above the roof nor less than 12" from any vertical surface nor within 10' of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2' minimum from gutters, parapets, ridges and roof flashing.

- C. Storm Drain (Including Rain Water Leader, RWL): Similar to Sanitary Sewer. Piping with less than 24" of cover outside building walls shall be cast iron.

- D. Water Piping: Connections to branches and risers shall be made from top of main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Minimum pipe size shall be 1/2", unless otherwise noted. Exposed fixture stops and flush valves shall be installed with brass nipples for copper piping and galvanized nipples for galvanized piping. Nipples are to extend from outside of wall to fitting at header or drop behind finish wall surfaces. Pipe nipples shall be same size as stop or flush valve. Provide shut off for each building and each connection to equipment. Shock absorbers shall be installed in a vertical position as indicated on drawings.
- E. Gas Piping: Installation shall comply with CPC and NFPA 54 (National Fuel Gas Code). Shall be pitched to drain to drip legs at low points where other than dry gas conditions exist. No unions shall be installed except at connections to equipment. Provide shutoff and dirt leg (sediment trap) at each equipment connection. Only equipment mounted on vibration isolators shall be connected with flexible connectors. Under floor piping shall be sleeved (and vented as required by code). Plastic pipe and fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions. Provide 14 gage insulated tracer wire secured to pipe at 10' intervals with nylon ties. Terminate tracer 6" above grade at both ends.
Odor Fade Warning – The odorant in propane (LP) and natural gas is colorless and the intensity of its odor can fade under some circumstances. Contact the utility company for more information.
Submit installer training certification from polyethylene piping manufacturer certified trainer, include copy of trainer's certification. Training shall have been completed no more than 6 months prior to starting work.
- F. Drain Piping (Including Condensate): Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide TEE with clean-out plug at all changes of direction. Provide trap at each air handling unit to prevent air leakage. Only equipment mounted on vibration isolators shall be connected with flexible connection. Piping not concealed in wall structure, above ceilings or below floors shall be chrome plated brass, except in equipment rooms, piping shall be galvanized steel. P&T relief and water heater drain piping shall be galvanized steel. Provide secondary drain piping where required.
- G. Plastic Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer's recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.
- H. Flue Piping: Flue piping shall be installed in accordance with its UL listing and the manufacturer's instructions.

3.2 PIPING INSULATION INSTALLATION:

- A. Domestic Hot Water:
1. General: All domestic hot water piping, fittings and accessories shall be insulated.
 2. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied pressure sealing tape.
 3. Fittings and Valves:
 - a. Wrap all fittings and valves with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Solvent weld. Seal all joints with factory supplied pressure sealing vapor barrier tape with 1-1/2"

- (min.) overlap on both sides of joint. Insulate valves to stem. Do not insulate unions, flanges or valves unless water temperature exceeds 140F or the piping is exposed to weather.
- b. For miscellaneous fittings and accessories for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the Contractor may cover the fiberglass blanket with stretchable glass fabric, one coat of lagging adhesive and a final coat of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.
4. Additional Finish for Exposed Piping and Equipment: All piping and equipment exposed to view but protected from the weather shall be given an additional finish of PVC jackets.
- B. Cold Water Piping-Freeze Protection: All cold water piping exposed to weather or other areas subject to freezing (i.e. ventilated attics, uninsulated exterior soffits, etc.) shall be insulated same as hot water piping. Cover with aluminum jacketing where exposed to weather. Short lengths of pipe and valves may be wrapped with insulating tape, 50% overlap. Cover valves to stem. Apply at least two coats of protective finish where exposed to weather.
- C. Piping Insulation Under Lavatories and Sinks: Exposed water piping, water stops and drain piping under lavatories and sinks shall be insulated with 1/8" thick molded closed cell vinyl. Installation shall be in accordance with manufacturer's instructions.

3.3 FIXTURE INSTALLATION:

- A. Fixture Height: Shall be as indicated on Architectural drawings.
- B. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted to proper height to drain. Cover openings during construction to keep all foreign matter out of drain line.
- C. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).
- D. Floor Mounted Fixtures: Shall be provided with proper support plates. Caulk floor mounted fixtures with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).
- E. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

3.4 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment. All equipment shall be securely anchored in place.
- B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.5 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.
- B. Gravity Systems:
 - 1. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10' above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
 - 2. Drains (Including Condensate): Similar to Sanitary Sewer.
 - 3. Storm Drain: Similar to Sanitary Sewer.
- C. Pressure Systems:
 - 1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made.
 - 2. Domestic Hot and Cold Water Piping: Maintain 100 psig water pressure for 4 hours.
 - 3. Gas Piping: Maintain 100 psig air pressure for 4 hours.

3.6 DISINFECTION:

- A. Disinfect all domestic water piping in accordance with 2022 CPC Section 609.10, and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, one set of water samples shall be collected by Contractor for bacteriological analysis in presence of Inspector. If the water fails the bacteriological test, Contractor shall disinfect the piping again and pay for any retesting required, at no additional cost to owner. Bacteriological testing results shall be obtained by Contractor and delivered to the Owner through the Architect before project completion. Contractor shall include copy of Bacteriological Test Results at closeout with operation and maintenance manuals.

END OF SECTION 22 00 00

SECTION 23 00 00

GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 GENERAL CONDITIONS:

- A. The preceding General and Special Conditions and Divisions 00 and 01 requirements shall form a part of this Section with the same force and effect as though repeated here. The provisions of this Section shall apply to all of the Sections of Divisions 21, 22 and 23 of these Specifications and shall be considered a part of these sections.

1.2 CODES AND REGULATIONS:

- A. All work and materials shall be in full accordance with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Drawings or Specifications call for material or methods of construction of a higher quality or standard than required by these codes, the Drawings and Specifications shall govern. Applicable codes and regulations include, but are not necessarily limited to, the following:
1. California Code of Regulations (CCR):
 - a. Title 8, Industrial Relations
 - b. Title 24, Part 1, Administrative Regulations
 - c. Title 24, Part 6, California Energy Code, 2022 Edition
 - d. Title 24, Part 11, California Green Building Code, 2022 Edition
 2. California Building Code - CBC - 2022
 3. California Mechanical Code - CMC - 2022
 4. California Plumbing Code - CPC - 2022
 5. California Fire Code - CFC - 2022
 6. California Electrical Code - CEC - 2022
 7. Air Diffusion Council - ADC
 8. Air Movement and Control Association - AMCA
 9. American National Standards Institute - ANSI
 10. Air Conditioning and Refrigeration Institute - ARI
 11. American Society of Heating, Refrigerating, and Air Conditioning Engineers - ASHRAE
 12. American Society of Mechanical Engineers - ASME
 13. American Society for Testing and Materials - ASTM
 14. American Water Works Association - AWWA
 15. Cast Iron Soil Pipe Institute - CISPI
 16. National Electrical Manufacturers Association - NEMA
 17. National Fire Protection Association - NFPA
 18. National Sanitation Foundation - NSF
 19. Occupational Safety and Health Act - OSHA
 20. Plumbing and Drainage Institute - PDI
 21. Sheet Metal and Air Conditioning Contractors National Association - SMACNA
 22. Underwriters' Laboratory - UL

1.3 PERMITS AND FEES:

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as part of the work included under

each system. All charges or fees for service connections, meters, etc. shall be included in the work.

1.4 COORDINATION OF WORK:

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interference with each other, or with structural, electrical, architectural or other elements. Verify the proper voltage and phase of all equipment with the electrical plans. If discrepancies are discovered between drawing and specification requirements, the more stringent requirement shall apply. All conflicts shall be called to the attention of the Architect and the Engineer prior to the installation of any work or the ordering of any equipment. No work shall be prefabricated or installed prior to this coordination. No costs will be allowed to the Contractor for any prefabrication or installation performed prior to this coordination.
- B. Mandatory Coordination and Shop Drawings:
 - 1. Prepare or have prepared high level detailed Shop Drawings in plan view, with cross-sections as necessary, indicating the proposed installation plan for all HVAC, mechanical, fire sprinkler, and plumbing installations for the project. These Drawings should depict actual elevations and linear dimensions, as well as all routing changes, transitions, major offsets, deck and structural attachments deemed necessary to accomplish the installation. Individual Shop Drawings may be prepared for each trade working within the designated space or area; however, the coordination of the consolidated installation shall remain the responsibility of the Contractor. These Shop Drawings shall be provided to each Subcontractor having Work in each area for coordination. Any fittings, offsets or other changes due to coordination shall be at no additional cost to Owner.
 - 2. Whereas the Drawings are diagrammatic, showing only the general arrangement of the systems, Contractor shall have responsibility for the fitting of materials and equipment to other parts of the equipment and structure, and to make adjustments as necessary or required to resolve space problems, preserve service room, and avoid architectural and structural elements and the Work of other trades. Contractor may be required to identify certain areas to relocate installations within the spaces depicted on the Drawings, e.g., ductwork and/or piping may be shifted within the space shown to accommodate other systems. Such functional relocations shall not be deemed a change to the requirements of the Contract. In the event a major re-routing of a system appears necessary, Contractor shall prepare and submit for approval, Shop Drawings of the proposed rearrangement.
 - 3. Because of the diagrammatic nature and small scale of the Drawings, all necessary offsets, adjustments, and transitions required for the complete installation are not shown. Contractor shall carefully investigate the conditions affecting all the Work and shall arrange such Work accordingly, furnishing such fittings, equipment, valves, accessories, offsets, etc., as may be required, regardless of size or cost, to meet such conditions, at no additional cost to the Owner.
 - 4. Coordination changes are not design changes and shall be provided at no additional cost to Owner. Coordination changes are not design changes and shall be provided at no additional cost to Owner. Any guidance, drawing or clarification issued by the Architect or Engineer to assist the Contractor or their sub-contractors in their coordination during construction are not design changes and shall be provided at no additional cost to Owner.
 - 5. Resolve differences or disputes between subcontractors and materials suppliers concerning coordination, interference, or extent of work between sections. The

Contractor's decisions, if consistent with the Contract Documents, shall be final. The Architect and their Consultants are not required to coordinate work between sections and will not do so. Any changes required that affect the design intent shall be presented to and approved by the Architect and Engineer of Record.

6. The coordinated Shop Drawings must be signed off by HVAC, Plumbing, Fire Sprinkler, Electrical, Framing, Ceiling Installation, and Data and Low Voltage Subcontractors.
7. The signed off Shop Drawings shall be submitted to the Owner's Representative for review and approval prior to commencement of installation.
8. Provide reviewed Shop Drawings to each Subcontractor having Work in each area.

1.5 GUARANTEE:

- A. Guarantee shall be in accordance with the General Conditions. These Specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the certificate of guarantee shall be furnished to the Owner through the Architect. Equipment that is started and operated prior to acceptance shall have the guarantee extended to cover that period. Owner guarantee shall start at acceptance.

1.6 QUIETNESS:

- A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.7 DAMAGES BY LEAKS:

- A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

1.8 EXAMINATION OF SITE:

- A. The Contractor shall examine the site, compare it with Plans and Specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.9 COMPATIBILITY WITH EXISTING SYSTEMS:

- A. Any work which is done as an addition, expansion or remodel of an existing system shall be compatible with that system.

1.10 MATERIALS AND EQUIPMENT:

- A. Materials and equipment shall be new unless otherwise noted. Materials and equipment of a given type shall be by the same manufacturer. Materials and equipment shall be free of dents, scratches, marks, shipping tags and all defacing features at time of project acceptance. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance.

1.11 SUBMITTALS:

- A. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project (this includes deferred approval items). Material or equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution.
- All shop drawings must comply with the following:
1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory. FAX submittals are not acceptable.
 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on drawings.
 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be high-lighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.
 4. Drawings shall be submitted in both hard copy and electronic form, electronic files shall be in their native format (i.e. DWG for AutoCAD, RVT for Revit, etc).
 5. Electronic Submittals: Where allowed by Division 01, electronic submittals are acceptable providing the following requirements are met:
 - a. Submittal shall be a single file in PDF format, with bookmarks for table of contents and each tab, and sub-bookmarks for each item.
 - b. All text shall be searchable (except text that is part of a graphic).
 - c. Submittal shall include all items noted in 1 through 3 above, except a binder is not required.
 - d. Electronic submittals shall be processed through normal channels. Do not submit directly to the Engineer unless the Engineer is the prime consultant for the project.
 - e. Contractor shall provide Owner and Owner's Representative with hard copies of the final submittal. Coordinate exact number required with Owner through Architect/Engineer.Electronic submittals which do not comply with the above requirements will be rejected.
- B. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and features desired (where equipment is scheduled on the drawings, any equipment submitted other than scheduled equipment is considered a substitution). Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items. At the Engineer's request, furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.

- C. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

1.12 MANUFACTURER'S RECOMMENDATIONS:

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

1.13 SCHEDULING OF WORK:

- A. All work shall be scheduled subject to the review of the Architect, Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner.

1.14 OPENINGS, CUTTING AND PATCHING:

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. Except as noted below, the actual openings and the required cutting and patching shall be provided by other Divisions. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall be provided by other Divisions. Cutting or coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Architect.

1.15 EXCAVATION AND BACKFILL:

- A. General: Barrel of pipe shall have uniform support on sand bed. Sand shall be free from clay or organic material, suitable for the purpose intended and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve. Unless otherwise noted, minimum earth cover above top of pipe or tubing outside building walls shall be 24", not including base and paving in paved areas.

- B. Excavation: Width of trenches at top of pipe shall be minimum of 16", plus the outside diameter of the pipe. Provide all shoring required by site conditions. Where over excavation occurs, provide compacted sand backfill to pipe bottom. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.
- C. Backfill:
 - 1. 6" Below, Around, and to 12" Above Pipe: Material shall be sand. Place carefully around and on top of pipe, taking care not to disturb piping, consolidate with vibrator. Native soil may be used where allowed by Geotechnical (Soils) Report. Where native soil is used, trenching for gravity drain pipe shall be done using a laser-level and trencher.
 - 2. One Foot Above Pipe to Grade: Material shall be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to review by Engineer.
- D. Compaction: Compact to density of 95% within building and under walkways, driveways, traffic areas, paved areas, etc. and to 90% elsewhere. Demonstrate proper compaction by testing at top, bottom and one-half of the trench depth. Perform these tests at three locations per 100' of trench.

1.16 PROTECTIVE COATING FOR UNDERGROUND PIPING:

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru-Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Johns-Manville. Protective coating shall be extended 6" above surrounding grade.

1.17 ACCESS DOORS:

- A. Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16-gage steel frame and 14-gage steel door with paintable finish, except in ceramic tile, where door shall be 16-gage stainless steel with satin finish. Continuous hinge. Key and cylinder lock (except quick-opening type for Emergency Gas Shutoff Valve). Deliver doors to the General Contractor for installation. Milcor. Unless otherwise noted, the minimum sizes shall be as follows:

1 valve up to 1-1/2"	12" x 12"
1 valve up to 3"	16" x 16"

1.18 HOUSEKEEPING PAD:

- A. Housekeeping pads shall be 6" high concrete, 3000 PSI strength, unless otherwise noted. Pad shall extend 6" beyond the largest dimensions of the equipment, unless otherwise noted. The top edge of the pad shall have a 3/4" chamfer. The pad shall have #4 reinforcing bars at 12" on center, each way, located at the mid-depth of the pad. If not poured at the same time as the floor slab with pad rebar tied to floor rebar, the pad shall be anchored as follows: Drill 1" diameter, 4" deep hole in floor. Fill hole with "Por-Rok", then insert 8" long, #4 rebar into hole. Provide a minimum of 4 of these anchors per pad, but no more than 4 feet apart in either direction. Anchor points shall be 12" from the edge of the pad.

1.19 CONCRETE ANCHORS:

- A. Steel bolt with expansion anchor requiring a drilled hole - powder driven anchors, adhesive anchors and concrete screws are not acceptable. Re-use of screw anchor holes shall not be permitted. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 12 diameters center to center and 6 diameters center to edge of concrete. Post-installed anchors in concrete used for component anchorage shall be pre-qualified for seismic application in accordance with ACI 355.2 and ICC-ES AC193. Post-installed anchors in masonry used for component anchorage shall be pre-qualified for seismic applications in accordance with ICC-ES AC01. Maximum allowable loads for tension and shear shall be as determined by Calculation in compliance with ACI 318-14, Chapter 17, and the anchor's ICC or IAPMO evaluation report. Hilti, Powers, Red Head.

1.20 EQUIPMENT ANCHORING:

- A. All equipment shall be securely anchored in accordance with ASCE 07-16, Chapter 13, as amended by CBC Section 1617A.1. All equipment mounted on concrete shall be secured with a concrete anchor as specified above at each mounting point. All air handlers shall be mounted on spring isolators. Secure base plate as indicated above.

1.21 SEISMIC SUPPORT AND RESTRAINT DESIGN SERVICE:

- A. All mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with ASCE 07-16, Chapter 13, as amended by CBC Section 1617A.1. Brace spacing shall be reduced by 50% for cast iron, plastic, no-hub, or other non-ductile piping.
- B. Contractor shall obtain the services of a Seismic Design service to provide engineered seismic supports and restraints for the project. Mason Industries, or pre-approved equal.
Note: Use of the "12 inch rule" does not exempt Contractor from this requirement.
 - 1. All seismic designs, including designs using HCAI pre-approvals, shall be submitted as project specific engineered designs sealed and signed by a licensed California structural engineer. All seismic designs shall include project / application specific seismic design demand calculations. Said seismic design demand calculations shall account for seismic forces in all applicable direction including axial, lateral, vertical tension, vertical compression, etc. Designs shall account for prying, eccentricity, uneven loading, weak axis bending, etc.
 - 2. Seismic restraint layouts for piping, ductwork and electrical raceways shall be furnished on shop drawings or added to the contractor's shop drawings and shall include:
 - a. The number, size and location of seismic braces.
 - b. Maximum support loads and seismic loads at the seismic brace locations.
 - c. Reference to specific details or pages from the HCAI pre-approved system (OPM).
 - d. **If use of the "12 inch rule" is intended by Contractor, design service shall verify locations where it is intended to be used is feasible and specifically identify these locations on the shop drawings, along with appropriate hanger details.**
 - 3. Installations not addressed by the OPM approval must be designed, detailed and submitted along with the shop drawings.
 - 4. Submit seismic restraint layout drawings and special details for approval of the project structural engineer per the requirements listed in the HCAI pre-approval (OPM).

5. Seismic restraint layout drawings shall bear the stamp and signature of the registered professional structural engineer licensed in the state of California who designed the layout of the braces.

1.22 ASBESTOS CONTAINING MATERIALS AND ASBESTOS REMOVAL:

- A. No materials or material coatings containing asbestos shall be allowed on this project.
- B. All asbestos removal shall be by Owner. Asbestos is to be removed before the work is started. If the Contractor discovers asbestos which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.23 SYSTEM IDENTIFICATION:

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by pre-printed markers or stenciled marking, and include arrows to show direction of flow. Pre-printed markers shall be the type that wrap completely around the pipe, requiring no other means of fastening such as tape, adhesive, etc. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Below Grade Piping: Bury a continuous, pre-printed, bright-colored, metallic ribbon marker capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.
- C. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-4) and identifies the area or space served by the equipment. Provide 1/2" high lettering - white on black background. Nameplates shall be permanently secured to the exterior of the unit.

1.24 CLEANING:

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work. This includes but is not limited to building surfaces, piping, equipment and ductwork, inside and out. Surfaces shall be free of dirt, grease, labels, tags, tape, rust, and all foreign material.
- B. At the end of each work day, the Contractor shall cover all open ends of piping and ductwork with protective plastic.

1.25 ACCEPTANCE TESTING:

- A. All acceptance testing as required by California Code of Regulations, Title 24, and as noted on the Certificate of Compliance form, (where applicable), shall be performed and documented by an Acceptance Test Technician (ATT). These documents must be provided to the building inspector during construction and must be completed through an Acceptance Test Technician Certification Provider (ATTCP). The Contractor shall submit a copy of the documentation to the Engineer for review (hardcopy or electronic), prior to submitting to Administrative Authority.

1.26 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Printed: Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts list for all faucets, trim, valves, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-3). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Pumps, Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **Electronic O & M's shall comply with the Electronic submittal requirements in this Section.**
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instructions that apply to the control system. The Engineer's office shall be notified 48 hours prior to this meeting.

1.27 RECORD DRAWINGS:

- A. The Contractor shall obtain one set of blue line prints for the project, upon which a record of all construction changes shall be made. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. building, curbs, walks. In addition, the water, gas, sewer, underfloor duct, etc. within the building shall be recorded by offset distances from building walls. As part of the Contractor's overhead expense, request a full set of reproducible drawings to transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review.

PART 2 PRODUCTS (not used)

PART 3 EXECUTION (not used)

END OF SECTION 23 00 00

SECTION 23 00 01

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 23 00 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
1. Air distribution system.
 2. All equipment as shown or noted on the drawings or as specified. Furnish motor starters except where motor control centers are used. Coordinate with Division 26.
 3. System energy balance.
 4. Coordinate with Section 23 09 23 (Direct Digital Control and Energy Management System) regarding location and installation of system sensors and to provide simultaneous start-up.
 5. Refrigeration system.
 6. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, ductwork, braces, supports, housekeeping pads, temperature controls and related items no longer required.
- B. Work Specified Elsewhere:
1. Line voltage power wiring, motor starters in motor control centers, disconnect switches and installation of all starters are included in the Electrical Section, unless otherwise noted.
 2. Connection of gas, condensate drains and domestic water to equipment.
 3. Concrete and reinforcing steel unless specifically called for in the drawings or specifications.
 4. Painting unless specifically called for in the drawings or specifications.
 5. Carpentry.
 6. Direct Digital Control and Energy Management System (DDC/EMS).

PART 2 PRODUCTS

2.1 PIPING MATERIALS:

- A. Refrigerant Piping: Hard drawn Type ACR copper, dried and capped, ASTM B280. Wrought copper fittings, silver alloy brazed, 1100°F, Silfos.
- B. Miscellaneous Piping Items:
1. Pipe Support:
 - a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendations. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Anvil, Unistrut.

- b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco.
 - c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Anvil, Unistrut.
2. Flashing: Flashing for piping through roof shall be prefabricated galvanized steel roof jacks with 16" square flange around pipe. Provide clamp-on storm collar and seal water tight with mastic. Maintain dielectric separation between copper and galvanized materials. For cold process built-up roof, material shall be 4 lb/ft² lead instead of galvanized steel. For single-ply roofing, use the roofing manufacturer's recommended flashing material.

2.2 PIPING INSULATION MATERIALS:

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.
- C. Aluminum Jacketing: Aluminum pipe and fitting jacketing, 0.016" thickness for straight pipe. 0.024" thickness for fittings. Integral moisture barrier. Stucco-Embossed finish. Provide pre-fabricated aluminum strapping and seals by same manufacturer. ITW or RPR.
- D. Metal Jacketing Sealant: Childers CP-76, Foster 95-44.
- E. Insulating Tape: Ground virgin cork and synthetic elastomeric. Black, odorless, and non-toxic. K factor 0.43 Btu-in/hr-ft²-°F or less. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Halstead.
- F. Foamed Plastic: Rubber based elastomeric preformed pipe insulation. Thermal conductivity shall not exceed 0.27 Btu-in/hr-ft²-°F at a mean temperature of 70°F. 1/2" thick. Provide adhesive by same manufacturer. Armacell Armaflex.

2.3 DUCTWORK MATERIALS:

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50. Shall comply with 2022 CMC.
- B. Metal Ductwork: Metal ductwork shall be galvanized sheet steel, lock forming quality, ASTM A-653, with gage and construction to match SMACNA Standard for pressure required (26 gage minimum).
- C. Flexible Ductwork: Insulated flexible ductwork. One pound per cubic foot glass fiber insulation, 1-1/2" thick (R-6), 2" thick (R-8) where ductwork is outside the building thermal insulation envelope. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft²-°F at a mean temperature of 75°F. Seamless metalized reinforced polyester vapor barrier jacket. Continuous internal liner bonded to galvanized steel wire helix. Duct shall be capable of continuous operation at 1-1/2" of positive water static pressure and 4,000 ft/min air velocity. Duct shall comply with NFPA 90A. JP Lamborn.

- D. Duct Sealants: All Joints Exposed to Weather: Sealant shall be water based, Foster 32-19/32-17, Childers CP-146/148, United Duct Sealer WB or G.E. "SilPruf" SCS2000 silicone sealant. Joints Not Exposed to Weather: Fiber reinforced. White in color. Foster 32-17, Childers CP-148, Design Polymeric DP1030, Hardcast Versa-Grip 181, Hardcast CCWI-181. Spiral Wound Joints Not Exposed to Weather and Exposed to View in Finished Areas: Non fibrated. Gray in color. Foster 32-19, Childers CP-146, Design Polymeric DP 1010, or United Duct Sealer WB.
- E. Spiral Wound Metal Ductwork: Spiral wound factory fabricated galvanized steel, gages in accordance with the CMC. All fittings shall be factory fabricated. Fittings exposed to view shall have all seams fully welded. Tees and laterals shall be conical type. Connections to plenums shall be with bell mouth fittings. 12" and smaller ells shall be two piece die stamped. Ells larger than 12" shall be five piece. McGill Airflow. Shop fabricated fittings are not acceptable.

2.4 AIR TERMINALS AND DUCT FITTINGS:

- A. Grilles: (Grilles, Registers, Diffusers and Louvers)
 - 1. Information on Drawings: Refer to Grille Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description Titus. Equivalent models of Anemostat or Krueger are acceptable. Refer to the floor plans for neck size, CFM, air diffusion pattern and fire damper, if required.
 - 2. Performance: Submit complete performance data (throw, pressure drop, noise level, etc.) for all grilles proposed, other than those scheduled. Testing shall be in accordance with ANSI/ASHRAE 70-1991. If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be reselected by the Contractor for the proper diffusion, spread, pressure drop, throw and noise level.
 - 3. Frame and Accessories: Supply, return, and exhaust grilles shall not have an opposed blade volume control damper unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawings. Key or screwdriver operated, no slide bars.
 - 4. Finish: All ceiling and wall grilles and all louvers shall have a paintable white finish unless otherwise noted. Interior components (everything behind the face plate) shall be flat black. Floor grilles shall have an anodized aluminum finish unless otherwise noted.
- B. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6" maximum blade width, 16-gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).
- C. Extractor: Curved blade turns in adjustable position rigid frame. Tuttle and Bailey Deflectrol.
- D. Turning Vanes: Double wall, hollow metal, air foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne HEP.

- E. Flexible Connection: UL listed neoprene coated 30 ounce fiberglass cloth. 3" metal, 3" fabric, 3" metal. Ventglas.

2.5 DUCTWORK INSULATION MATERIALS:

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Fiberglass Blanket: **Installed** thermal resistance at a mean temperature of 75°F shall meet or exceed indicated value. 3/4 lb/ft³ or 1 lb/ft³, **R-6** where ductwork is within the building thermal insulation envelope. 3/4 lb/ft³ **R-8** where ductwork is outside the building thermal insulation envelope and/or above the roof. Faced with glass reinforced foil laminated to Kraft paper. Certainteed, Knauf, Johns-Manville, Owens-Corning.
- C. Acoustic Lining: Glass fiber. **Installed** thermal resistance at a mean temperature of 75°F shall meet or exceed indicated value. One side coated to prevent fiber erosion up to 6000 ft/min. Average noise reduction coefficient of 0.80. 1.5 lb/ft³ density. 1" thick (**R-4.2**) where ductwork is within the building thermal insulation envelope. 2" thick (**R-8**) where ductwork is outside the building thermal insulation envelope and/or above the roof. Certainteed, Knauf, Johns-Manville, Owens-Corning.
- D. Bonding Adhesive: Design Polymerics DP2501, Foster 85-60.

2.6 EQUIPMENT:

- A. General Requirements:
 - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
 - 3. Ratings - Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
 - 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
 - 5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be

- separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
- c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
 - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
 - e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.
6. Fan Selection:
- a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency toward increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM versus static pressure with constant brake horsepower, RPM and efficiency lines.
 - b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
- a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance is completed and prior to acceptance.
 - b. Filter Media: 2" media. MERV-13. Clean filter resistance 0.41" water at 500 fpm. Throw-away frame. Class 2. Camfil AP-Thirteen.
 - c. Filter Media: 2" media. MERV-8. Clean filter resistance 0.31" water at 500 fpm. Throw away frame. Class 2. Camfil 30/30.
8. Screens: All duct or louver openings to the outside shall be covered with 1/2", 16-gage, galvanized wire mesh screen.
9. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.

10. Sound Ratings: Shall be in accordance with ASHRAE 36 - 72. Sound ratings shall not exceed scheduled values.
 11. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.
- B. Packaged Heat Pump:
1. General: Self contained heat pump designed for outdoor installation. Factory assembled and tested. Refer to Paragraph 2.6A for general requirements. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Indoor air section fully insulated. Outside air inlet. Drain pan. Multivane centrifugal supply fan. ARI certified. Aaon.
 2. Refrigeration: Sealed hermetic compressor with internal vibration isolating mount. Crankcase heater, high/low pressure switch, recycling timer. Suction line accumulator. Air cooled condenser with propeller fan. Non ferrous finned coil. Low ambient control to 35 degrees. 5 year extended warranty on compressor(s).
 3. Controls: Compressor and fan motors shall have both thermal and current sensitive overload devices. Automatic defrost control (only if required) every 90 minutes for a period of not more than 10 minutes.
 4. Accessories: Electric resistance heater, nichrome elements, over temperature and overcurrent protection. Emergency heat control to allow heater operation if compressor is inoperative. See Equipment Schedule on Mechanical Drawings Sheet M4.1 for additional accessories.
- C. Exhaust Fan:
1. General: All exhaust fans shall be tested according to AMCA Standard 210 in an AMCA registered laboratory. Fans exposed to weather shall have ventilated weatherproof housing over motor and drive assembly. Refer to Paragraph 2.6A for general requirements. All direct drive fans shall be provided with unit mounted speed controllers, unless otherwise noted. All motors 1 horsepower and larger shall be the premium efficiency type.
 2. Roof Fan (Direct Drive): Spun aluminum, roof mounted, direct driven, downblast centrifugal exhaust ventilator. Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners and stainless-steel fasteners on cap. Spun aluminum structural components shall be constructed of minimum 16-gauge marine alloy aluminum, bolted to a rigid aluminum support structure. Aluminum base shall have continuously welded curb cap corners for maximum leak protection. Discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Motor shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. An aerodynamic aluminum inlet cone shall be provided for maximum performance and efficiency. Motor shall be heavy duty type with permanently lubricated sealed bearings and furnished at the specified voltage, phase and enclosure. Backdraft damper. Greenheck.

3. Ceiling Fan: Ceiling mounted, 6 airfoil blades with winglets, 14-foot diameter fan. Mounting hardware. Motor with Class F insulation. Onboard NEMA 4X, VFD with RFI and EMI filters and wall mounted keypad. Optional BAS interface (coordinate with factory). Blade retainer links. Safety cable. Guy wires. Big Ass Fans.
- D. Indoor/Outdoor Unit:
1. General: Refer to Paragraph 2.6A for General Requirements. Completely assembled and factory tested. Provide all starters and relays required for operation. All components by same manufacturer. Mitsubishi.
 2. Outdoor Unit:
 - a. Compressor: Sealed hermetic rotary compressor with vibration isolator mountings. Crankcase heater, suction line accumulator, recycling timer. High and low head pressure/temperature protection. Motor overload protection, low ambient feature to 20F cooling mode. High and low side service valves. Recycling timer. Single phase start assist kit. 5-year extended warranty.
 - b. Fan and Coil: Finned tube non-ferrous coil. Propeller type fan, 1200 RPM maximum, direct drive. Totally enclosed motor, overload protected, permanently lubricated, resiliently mounted.
 - c. Cabinet: Weatherproof, factory paint.
 3. Indoor Unit:
 - a. Supply Fan: Direct drive, multi-speed forward curve, centrifugal fan, resiliently mounted. Thermally protected motor.
 - b. Indoor Coil: Copper tube, aluminum fin, DX coil.
 - c. Electric Heaters: Integral part of unit, complete with all operational and safety controls, single point wiring terminal, 5-year factory warranty, UL listed as a complete unit.
 - d. Condensate Pan: Install under complete coil area with drain connections.
 - e. Filter: Washable media. Class 2 or better.
 4. Controls: Microprocessor control containing temperature selection, room temperature indication, automatic heating/cooling changeover, malfunction alarm, power failure automatic restart safety, and emergency operation function. BACnet interface card.
- E. Energy Recovery Ventilator:
1. General: Rooftop packaged energy recovery ventilator. Refer to Paragraph 2.6A for general requirements. Units shall be listed per ANSI/UL 1995, Heating and Cooling Equipment. Energy transfer ratings of the energy recovery wheel shall be ARI Certified. Ventilators shall bear the AMCA Certified Rating Seals for Air Performance. Performance shall be as scheduled on plans. Outdoor air shall not mix with exhaust air in a common plenum. Exhaust discharge and outside air intake shall not be located on the same side on roof top units. Greenheck Model ERV.
 2. Unit Casing And Frames: Unit shall be of internal frame type construction of galvanized steel. Frame and panels shall be G90 galvanized steel. All panels exposed to the weather shall be a minimum of 18 gauge galvanized steel. Where top panels are joined there shall be a standing seam to insure positive weather protection. All metal-to-metal seams shall be sealed, requiring no caulking at job site. Permatector exterior finish is available for outdoor units. Unit base to be designed for curb mounting. Unit base shall over hang the curb for a positive seal against water run-off.
 3. Weatherhood: Weatherhoods shall be the same finish as the unit. Outdoor air weatherhood shall incorporate a louvered design and moisture eliminator. Weatherhoods shall be tested in accordance with AMCA Standard 500-L and achieve an 'A' water penetration classification rating up to 8 in/hr rainfall at 50 mph.
 4. Insulation: Unit casing to be insulated with 1 inch fiberglass with Foil-Scrim-Kraft

- facing. Insulation shall meet requirements of NFPA 90A and tested to meet UL 181 erosion requirements. Insulation shall be secured to unit with waterproof adhesive and permanent mechanical fasteners.
5. Energy Recovery Wheel: Wheel shall be of the enthalpy type for both sensible and latent heat recovery and be designed to insure laminar flow. Energy transfer ratings must be ARI Certified to Standard 1060 and bear the ARI certification symbol for ARI Air-to-Air Energy Recovery Ventilation Equipment Certification Program based on ARI 1060. Ratings "in accordance with 1060" without certification are not acceptable. Desiccant shall be silica gel for maximum latent energy transfer. Wheel shall be constructed of lightweight polymer media to minimize shaft and bearing loads. Polymer media shall be mounted in a stainless-steel rotor for corrosion resistance.
- Wheel design shall consist of removable segments (for wheels greater than 26 inches in diameter) for ease of service and/or cleaning. Silica gel desiccant shall be permanently bonded to wheel media to retain latent heat recovery after cleaning. Wheels with sprayed on desiccant coatings are not acceptable. Wheels with desiccant applied after wheel formation are not acceptable. Energy recovery device shall transfer moisture entirely in the vapor phase.
- Energy recovery drive belt material shall be high strength urethane and shall be factory installed in a pre-stretched state, eliminating the need for field belt tension adjustment. Link style belts are not acceptable.
6. Access Doors: All components shall be easily accessible through removable doors for exhaust, supply, filter, and damper compartments. Energy recovery wheels (smaller than 54 inches) shall be mounted in a slide-out track for ease of inspection, removal, and cleaning.
7. Roof Curbs: Factory sloped roof curb to be supplied by unit manufacturer for field assembly. Curb shall consist of die formed galvanized steel sections. Curb shall be full perimeter type with gasketing provided for field installation between curb and unit base.
8. Fan Sections: Centrifugal fans to be double width, double inlet, single fan forward curved type. All blower wheels shall be statically and dynamically balanced. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Separate motors for exhaust and supply blowers shall be provided. Adjustable sheaves on belt-driven fans with motors less than 10 hp shall allow independent balancing of exhaust and supply airflows. Optional speed controllers on direct-drive fans shall allow independent balancing of exhaust and supply airflows. Fan and motor assemblies are mounted to unit base with neoprene isolators as standard. Fans shall be located in draw-through position in reference to the energy recovery wheel.
9. Motors and Drives: Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy-duty type, matched to the fan load and furnished at the specified voltage, phase, and enclosure. Belt-drive motors shall be factory mounted to an adjustable motor plate having two heavy-duty adjusting bolts for alignment and belt tension. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast type, keyed and securely attached to the fan wheel and motor shafts; 10 horsepower and less shall be supplied with an adjustable drive pulley. Energy wheel motors and direct-drive motors shall have integral overload protection.
10. Filters: Supply and exhaust air filters shall be 2-inch thick pleated fiberglass, 30% efficient and tested to meet UL Class 2. Filter racks shall be die-formed galvanized steel.
11. Electrical: All internal electrical components shall be factory wired for single point power connection. All electrical components shall be UL Listed, Approved or

Classified where applicable and wired in compliance with the California Electrical Code.

Weatherproof, integral door interlocking disconnect switch, motor starters, control circuit fusing, control transformer for 24 VAC circuit, and terminal strip shall be supplied as standard components in the control center. Motor starters consist of a contactor and Class 20 adjustable overload protection and shall be provided for all motors in the unit.

12. Warranty: The energy recovery wheel shall be warranted to be free from defects in material and workmanship for a period of five years from the purchase date.

PART 3 EXECUTION

3.1 PIPING INSTALLATION:

A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Lines shall be adequately braced against vertical and lateral movement. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Pipe sizes shall not decrease in direction of flow, unless otherwise noted.
2. Joints:
 - a. Threaded: Pipe shall be cut square, and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
 - b. Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100°F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
 - c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
3. Fittings and Valves:
 - a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
 - b. Reducers: Pipe size reduction shall be made with bell reducer fittings (eccentric bell for steam service). Bushings shall not be used.
4. Pipe Support:
 - a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below (based on straight lengths of pipe with couplings only). Provide additional supports for equipment, valves or other fittings. Seismic requirements may reduce maximum spacing. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping

- shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction.
- b. Refrigerant Piping: Support insulated refrigerant line with construction channel and sheet metal support saddle or Cooper B-Line Armafix clamps. 5' spacing. Use isolation shield for uninsulated pipe. When using pre-charged tubing, all changes of direction shall be made with bending tools producing neat uniform bends. Free hand bends will not be accepted.
 - c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.
5. Miscellaneous:
- a. Escutcheons: Provide chrome plated escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
 - b. Pipe Sleeves: All piping passing through concrete or concrete block shall be provided with pipe sleeves. Allow 1" (nominal) clearance between sleeve and pipe or pipe insulation. Piping through walls below grade shall be sealed with Link-Seal.
 - c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of 2022 CBC Section 714.
- B. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted and erected before brazing. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70°F. After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment. Refrigerant piping below grade shall be run in 4" (min.) PVC conduit with long radius ells. Seal ends of conduit watertight.

3.2 PIPING INSULATION INSTALLATION:

- A. Refrigerant Piping: Cover piping with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendations. Cover all fittings, unions, valves and connections. Piping exposed to view shall be covered with PVC jacketing. Piping exposed to weather shall be covered with aluminum jacketing, install all joints and seams to prevent water entry, seal with 1/8" bead of gray metal jacketing sealant.

3.3 DUCTWORK INSTALLATION:

- A. General:
- 1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA Standards. Ductwork shall be built to a pressure classification equal to or greater than the maximum operating pressure at that point in the ductwork. A copy of these standards shall be maintained at the job site at all times. Duct work and accessories shall be installed in a manner to prevent vibration and rattling.
 - 2. Access: Provide duct access doors as required to adjust equipment and dampers. Provide wall or ceiling access panels, or remote actuators as required where equipment and dampers are not otherwise accessible. See remote regulator detail on Drawings Sheet M5.1.
 - 3. Flexible Connections: Connection of ductwork to any vibrating equipment shall be with 3" (min.) flexible connection. Install with ample slack and uniform gap. There shall be no metal-to-metal contact across flexible connection. Flexible connections exposed to weather shall have a protective sheet metal cover.

4. Flanges and Escutcheon: Where ductwork penetrates walls, ceilings, or floors, furnish and install flange or escutcheon of same material as duct.
- B. Low Velocity-Low Pressure (up to 2,000 ft/min and up to 2.0 in water):
 1. Sheet Metal Ductwork:
 - a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
 - b. Tees: Tees in supply ductwork shall be straight tap-in with extractor or 45 degree take-off as shown on drawings. Grilles or branches in supply ductwork shall be a minimum of 8 duct diameters downstream of tees.
 - c. Duct Joints and Seams: All joints and seams which are not exposed to weather shall be sealed airtight with duct sealant. All joints and seams exposed to weather shall be sealed air and water tight with silicone sealant. (See Part 2 of this Specification). All joints on spiral wound metal ductwork not exposed to weather shall be sealed air tight with grey duct sealant.
 - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
 2. Flexible Glass Fiber Ductwork: The use of flexible duct is limited to the last 5 feet of each branch duct (i.e. one 5 foot section of flexible duct may be used to connect the grille to the sheet metal branch duct). No joints are permitted in this 5' length. Hangers shall be 4" wide metal straps spaced to prevent sagging, 42" spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. Joints shall be installed with stainless steel or nylon draw bands, Duro Dyne Dyn-O-Tie. Minimum turn radius of duct centerline not less than 1.5 times the duct diameter. Install without excess length. Ducts shall not be compressed.
 3. Spiral Wound Metal Ductwork: At side duct grilles, the grille shall be cut directly into the spiral duct. Duct to duct joints shall be made with the spiral seam rotated so that the seam forms a continuous helical pattern across the joint.

3.4 AIR TERMINALS AND DUCT FITTINGS INSTALLATION:

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA Standards. Terminals and fittings shall be installed in a manner to prevent vibration and rattling. Metal surfaces exposed to view behind grilles and registers shall be painted flat black.

3.5 DUCTWORK INSULATION INSTALLATION:

- A. General: Insulate all sheet metal supply, return and outside air intake ductwork except as noted below. Insulation shall be continuous through walls and floors except at fire dampers.
- B. Where Insulation Is Not Required: Do not insulate factory-insulated ducts or casings, acoustic lined ducts, fibrous glass ducts, underground ductwork, supply or return ductwork exposed to view in the space that it serves, or exhaust ductwork.
- C. Concealed Ductwork: Wrap concealed ductwork including outside air intakes with fiberglass blanket lapped 2" minimum. Secure with staples 4" on centers maximum on straight runs and 3" maximum at elbows and fittings. Insulation on bottom of ducts wider than 36" shall also be secured with mechanical fasteners at 24" on center.
- D. Acoustic Lining: Unless otherwise indicated, all supply and return ductwork in equipment rooms, all ductwork exposed to weather and other ducts as indicated on drawings, shall have acoustic lining. Do not acoustic line outside air intakes, evaporative cooling ductwork or ductwork downstream of high efficiency filters. Where acoustic lining is installed,

increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and also secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.6 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block or otherwise hinder the equipment. All equipment shall be securely anchored in place. All equipment shall be installed level.
- B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.
- C. Equipment Platforms: Shall be as shown on drawings and as follows: Flashing and platform cover shall be 22 gage (min.) sheet metal. All joints and seams shall be soldered with 2" (min.) overlaps. Provide 3/4" gap around perimeter between roofing and platform cover to facilitate re-roofing. Extend drip lip down 3" (min.). Provide 30# felt under platform cover.

3.7 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested.

3.8 SYSTEM ENERGY BALANCE:

- A. Scope: Provide the services of an independent test and balance agency to test, adjust and balance, retest and record performance of the system to obtain design quantities as specified. The agency must prove that they have no affiliation with any equipment manufacturer, design engineer, installing contractor, or any other party which might lead to a conflict of interest, in order to provide an unbiased, third party system balance and report.
- B. Qualifications: Prior to commencing work, the agency shall be reviewed by the Engineer and shall be certified by the Associated Air Balance Council, National Environmental Balancing Bureau or Testing, Adjusting and Balancing Bureau. The agency shall provide documentation of having successfully completed at least five projects of similar size and scope.
- C. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC, NEBB or TABB standards.
- D. Submittals: Include in shop drawings copies of forms to be used for testing and balancing showing all data which is to be recorded. Three copies of completed balance report shall be submitted to and reviewed by the Mechanical Engineer prior to the final mechanical construction review.
- E. Procedure - General: Procedure shall be in accordance with Associated Air Balance Council's "National Standards for Field Measurements and Instrumentation - Total System Balance", Volume Two, No. 12173, or equivalent NEBB or TABB standards. System shall be in full, continuous operation during test. Balanced quantities shall be plus 10%, minus

0% of design quantities. All nameplate data, manufacturer, model and serial numbers shall be recorded for each item tested.

- F. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Engineer, at his discretion, may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Engineer in making any tests he may require during this period of time.
- G. Air Balance Procedure (For Each Air Handling System):
1. All air filters shall be clean when air balance is performed.
 2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
 3. Adjust blower RPM to design requirements.
 4. Record motor full load amperes.
 5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
 6. Record system static pressures, inlet and discharge.
 7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.
 8. Adjust system for design CFM recirculated air.
 9. Adjust system for design CFM outside air.
 10. Record entering air temperatures. (DB heating, DB and WB cooling.)
 11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
 12. Adjust all main supply and return air ducts to design CFM.
 13. Adjust all zones to design CFM, supply and return.
 14. Adjust all diffusers, grilles and registers to plus 10%, minus 0% of design requirements.
 15. Adjust CFM at all exhaust fans, make-up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.
 16. Each grille, diffuser and register shall be identified as to location.
 17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees upward deflection unless otherwise noted. Make a notation of any that are not set properly.
 18. Size, type and manufacturer of diffusers, grilles, registers and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
 19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
 20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
 21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
 22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.
 23. Set, test and adjust packaged heating/cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.

END OF SECTION 23 00 01

SECTION 23 09 23

DIRECT DIGITAL CONTROL AND ENERGY MANAGEMENT SYSTEM

PART 1 GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions of Section 23 00 00 shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

- A. General: The direct digital control and energy management system (DDC/EMS) includes control panels, control devices, valves, actuators, all line and low voltage control and interlock wiring (including wiring to controllers, switches, timers, relays, etc.) and conduit and related equipment, as required for proper operation of all equipment. Provide all equipment, programming, labor, materials and services necessary for a complete, lawful and operating DDC/EMS as shown or noted on the drawings and as specified herein. All control wiring, line and low voltage shall be installed in conduit. Power wiring, power to DDC/EMS control panels and disconnect switches are included in the Electrical Specifications, except that power wiring for control devices such as controllers, valves, etc., is included in the control system. Electrical work shall be in accordance with Electrical Specifications. Set, test and adjust the system for proper operation. The controls system shall be direct digital control/electric. **Johnson Metasys, without substitution, to match existing. Provided and installed by Bedard Controls, 559-271-8990, No Exceptions.** Except as otherwise noted, the control system shall consist of all Ethernet Network Controllers. The system shall be BACnet protocol and shall be compatible with existing district-wide system. The system shall communicate over the District's Ethernet LAN/WAN, and shall include the latest upgrading (software and firmware) during the warranty period. **All existing network controllers on District School sites shall have their software upgraded to the same revision as that installed at this site.** The data wiring shall have an Ethernet connection at the DDC/EMS panel and at the onsite workstation.
If the District's current Graphical User Interface is server based, the GUI must be integrated into the District's current GUI server. The design of the total installed system shall be based on such systems, which are the District standards. Coordinate with Section 23 00 01, Heating, Ventilating and Air Conditioning and with Division 26.
- B. Contractor Qualifications: All controls shall be furnished and installed by a Contractor who is licensed, certified or contracted by the controls manufacturer for design, installation, start-up and service of their product. The Contractor must have factory supplied training and support. The Contractor must have sufficient personnel to respond to a trouble call at the site within four hours. The Contractor's local manager shall have a minimum of five years' experience in the design, installation, start-up and service of similar systems. The Contractor shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number and controls contract value.
- C. Submittals: Within 60 days of contract award, submit eight (8) copies of shop drawings showing the following aspects of the DDC/EMS system (CAD file with DXF format if required of floor and site plans can be secured from the Architect).

1. All termination points, terminal cabinets, and cabling.
 2. Schedule of input and output points.
 3. Locations of all visible DDC/EMS system components (i.e. interior and exterior sensors, terminal strips, panels, trench and pull boxes, etc.), identifying specifically any exposed conduit.
 4. Complete written sequence of operation.
 5. Descriptive literature for all material and equipment items shall include manufacturer's name and catalog numbers, dimensions, capacities, and all other characteristics and accessories as listed in the specifications or on the drawings.
 6. Submit copies of forms to be used for testing and verification showing all data which is to be recorded. Three copies of complete report shall be submitted for review.
- D. Utility Interfacing: Coordinate interface, via equipment modem and District Ethernet connections furnished by Supplier to Owner's dedicated telephone line or Ethernet network. The DDC/EMS Contractor shall interface with the PG&E electric meter to allow DDC/EMS monitoring and logging of electricity usage, and pay any costs to the utility for such as to comply with PG&E installation requirements.
- E. Installation and Operation Manuals: Furnish Installation and Operating Manuals for all components. These manuals shall contain full documentation which shall include, without being limited to, the following:
1. General description and specifications.
 2. Installation and initial checkout procedures.
 3. Principles and theory of operation.
 4. Complete trouble-shooting procedures and diagrams.
 5. Complete alignment and calibration procedures for all components.
 6. Program source file on CD or 3-1/2" disk (ASCII text file) and hard copy.
 7. Detailed schematics and assembly drawings.
 8. Complete recommended spare parts lists including unit prices.

1.3 SYSTEM ARCHITECTURE

- A. DDC/EMS Equipment: The main controller shall contain the network communications and information management programs providing integrated global control, trend logging, local and remote alarming and fully menu driven user interface. It may be equipped with at least 64 local controllers on each network. The local controller is an intelligent, stand-alone microprocessor based controller which can have a variety of configurations based on their application.
- B. Campus-Wide Data Transfer System: The DDC/EMS shop drawings shall indicate where all equipment items are to be located for input and output to complete the system. The conduit/cabling system shall inter-tie these points as required to complete one system to meet the design criteria herein. System high speed communication (LAN) shall be hardwired using a Belden shielded cable as recommended by DDC manufacturer and shall communicate at 10M baud with peer to peer communication. System communication between master controller and local controllers (field bus) shall be at 19.2K baud minimum with a two wire shielded RS-485 cable. See Drawings for exterior lighting circuits to be controlled by contactors at panels.

- C. User Interface Communication: The user may communicate with the DDC/EMS system with a workstation located at the District Office over the WAN, with a remote workstation via a telephone modem, with an On-Campus Operator Workstation, and with a Lap-Top computer (Service Tool). The system shall be configured to allow the Service Tool to access data and program any controller on the system from any room sensor service port. Alternatively, a conveniently located service port shall be provided in each building that allows access to data and programming of any controller on the system, if the room sensor service port is limited to only the controller to which the sensor is connected.
- D. Standard Network Support: All Master Controllers, Workstation(s) and File Server shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN. Furthermore, the Master Controllers, Workstation(s) and File Server shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.

PART 2 PRODUCTS

2.1 GENERAL:

- A. The Electronic Microprocessor Based Direct Digital Control and Energy Management System (DDC/EMS) shall monitor the data environment and perform control functions in relation to a programmed strategy and the status of the data environment. The system shall use solid state computer based digital and analog technology. The system shall be standard with the manufacturer to insure ongoing parts availability and trained technical support. The DDC/EMS shall be of the user programmable type requiring no special computer education for operation. All necessary instruction manuals and user orientation training shall be supplied by the manufacturer or agent thereof. The DDC/EMS shall be UL listed as a Direct Digital Control and Energy Management System. The programmable control requirements of the DDC/EMS shall include, but not be limited to:
 - OPTIMUM START/STOP (BASED ON HISTORICAL DATA)
 - TIME OF DAY ROUTINES
 - SCHEDULED OCCUPANCY ROUTINES INCLUDING HOLIDAYS
 - CUSTOM TAILORED REPORTING
 - ACCUMULATING RUN TIME
 - CRITICAL CONDITION ALARMING
 - FLUID FLOW SWITCH AND CONTROL ALARMING
 - PID CONTROL ON ANALOG OUTPUTS
 - HOT WATER RESET
 - DAY/NIGHT SETBACK
 - ECONOMIZER/PURGE
 - CUSTOM TAILORED REPORTING
 - ACCUMULATING RUN TIME
 - SEPARATE MODES AS REQUIRED BY CONTROL SEQUENCE
- B. Environment: The DDC/EMS shall operate in an environment of 40 120 degrees F and 10 95% relative humidity. Sensors and control elements shall operate under the temperature, pressure, humidity, and vibration conditions normally encountered in the installed location. The DDC/EMS shall maintain accuracy as follows:
 - 1. +/- 0.5 F for the space temperatures in the 0 F 130 F range.

2. +/- 0.5 F for duct temperatures in the 40 F - 130 F range.
 3. +/- 1.0 F for outside air temperatures in the 30 - 230 F range.
 4. +/- 1.0 F for water temperature in the 30 - 230 F range.
 5. KWH and KW monitoring within 1.0%.
- C. Battery Backup: The system shall be tolerant of power failure and hold memory for a minimum of 12 hours. On power restoration, the system shall automatically and without operator intervention of execution of manual restart procedures:
1. Come On Line.
 2. Update all monitored functions.
 3. Resume operation based on current time and status.
 4. Implement special building start up strategies as required.
 5. Log time of power outages and start ups.
- D. Program Storage: The system shall also be capable of interfacing with a mass storage (tape or disc) device, for use in uploading and downloading programs to the DDC/EMS.
- E. Protocol: Protocol shall be BACnet.

2.2 SYSTEMS DESCRIPTION:

- A. Modular Design/Expandability: The DDC/EMS shall be of a modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions. System size shall be expandable from 4 input points and 4 output points to unlimited. Expansion shall be in modules. The modular DDC/EMS shall be configured on the main/local concept. The main controller shall have the capability of adding local controllers and the local controllers shall be capable of adding I/O modules.
- B. Main (Master) Description: The master shall function as the overall system coordinator, accept control programs, perform automated energy management functions, control peripheral devices and perform all necessary mathematical calculations. The master shall be a microcomputer of modular design. The word size shall be 16 bits or larger, with a memory cycle time less than 1 microsecond. All chips shall be second sourced. The master shall have the following:
1. Protected Access: Key lock protected access to output override switches and internal circuitry.
 2. Memory: The master shall have at least 2 MB of user available memory, in addition to memory required for systems operation and diagnostics or MCP software. Minimum requirements for system operation are as follows: A minimum of 4MB of RAM shall be provided for masters with expansion up to 8MB. The 8MB versions shall include a floating-point math co-processor.
 3. Real Time Clock: The master shall have a battery backed uninterruptable "Real Time Clock". The accuracy shall be within ten seconds per day. The RTC shall provide the following information: Time of Day, Day, Month, Year, and Day of Week. The system shall be programmed to automatically correct the clock for day light savings time and leap years.
 4. Power: The master shall operate from 120 VAC +/- 20%, 60 Hz. Line voltages below the operating range of the system shall be considered outages. The master shall have over voltage surge protection, and require no additional AC power signal conditioning.
 5. Parallel Processing: The master shall be capable of parallel processing, executing separate control programs simultaneously. Any control program may

- affect control of another program if desired. Each program shall have full access to all I/O facilities of the processors.
6. Communications Processor: Each master shall provide communication to both the Workstation(s) (LAN) and the field buses (RS-485). In addition, each master must have at least 3 other communications ports that support a telephone modem, portable service tool, serial printer and connection to third party controllers such as a chiller control panel or Variable Frequency Drives. On a LAN/WAN system the master(s) shall be provided with a 10Mbps plug-in Ethernet TCP/IP network interface card (NIC).
 7. Uninterruptable Functions: Control functions shall not be interrupted due to program entry or other user communications.
- C. Local Controller Units: The local units function as a stand-alone controller and as an Input/Output interface of the DDC/EMS and the Data Environment.
1. Monitoring: Local units shall be used to connect the data environment to the system and contain all necessary Input/Output functions to read field sensors and operate controlled equipment based on internal instructions or instructions from the Master. The units shall be fully supervised to detect failures. The units shall report the status of all points in its data environment at the rate of at least once every second. Local units shall connect directly to the Master with a twisted pair shielded RS-485 interface. All local units can run independently in the event of a central unit failure.
 2. Unit Failure: Upon failure of the unit (including transmission failure), the unit shall automatically fail off or to a predetermined state for three-way valves. A message shall be transmitted by the unit indicating a local unit failure.
 3. Power: The unit shall operate from 120 VAC, +/-20%, 60 Hz, 220 VAC, +/-20%, 50 Hz or 24 VAC +/- 20%, 50/60 Hz power. For voltages below the operating threshold the unit shall totally shutdown and de energize its outputs.
 4. LAN and/or Field Bus: Each unit shall communicate with any unit through the RS-485 interface LAN and/or field bus.
 5. Auxiliary Port: Each unit shall be equipped with an auxiliary port to allow local interrogation of input and output values, and keyboard override of outputs through laptop.

2.3 INPUT/OUTPUT CAPABILITY:

- A. Inputs: The DDC/EMS shall accept information in the form of a temperature, voltage, digital signal (on off) or pulse counter.
1. Analog Inputs: The Analog Input (AI) function shall monitor each analog input, perform A/D conversion, and hold the digital value in a buffer for interrogation. The A/D conversion shall have a minimum resolution of 10 bits. Input ranges shall be within the range of 0 10 VDC.
 2. Digital Inputs: The Digital Input (DI) function shall accept dry contact closures and voltage level or resistance level (5VDC reference voltage) transitions. A voltage level below 1 volt or a resistance below 500 ohms shall be read as ON (closed), a voltage level above 3 volts or a resistance above 1400 ohms shall be read as OFF (open).
 3. Pulse Accumulator Inputs: The pulse accumulator function shall have the same characteristics as the DI, except that, in addition, a buffer shall be included to totalize pulses between interrogations. Each input shall accept pulses at a minimum of 2 per second.
 4. Temperature Inputs: Temperature inputs originating from a thermistor shall be monitored and buffered as an AI, except that, automatic conversion to degrees F shall occur without any additional signal conditioning.

5. Input Wiring: All analog inputs shall be two wire devices, with shielded wire for accurate operation.
- B. Outputs:
1. Master and local controllers - Form C relay outputs rated at 5 amp, 24 VAC/DC or 2 amp, 30 VAC for on/off or Pulse Width Modulation for maintained operation of field devices. Output pulse width shall be selectable between 0.1 and 3200 seconds with a minimum resolution of 0.1 seconds. Isolation and protection against voltage surges shall be provided. Central plant controllers shall be equipped with an ON/OFF/AUTO switch to manually obtain either output state. Manual overrides shall be reported to the master at each update. An LED shall be provided to indicate the state of each digital output.

2.4 SOFTWARE:

- C. User Software: Provide software for On-Campus workstation, Laptop Computer (Service Tool) and District office workstation (required upgrades and programming only if software is already existing on District office workstation).
- D. Software Features:
1. Mathematical Requirements: The DDC/EMS shall have a math package capable of addition, subtraction, multiplication, division, square root, greater than and less than functions, minimum and maximum selection functions, and up to five levels of parenthesis for computation of variables. Control commands may be executed based on these calculated variables which are available to the program on a global basis. Math expressions may be used in action and exit commands of control program. The mathematical software shall be capable of mixed mode arithmetic, utilizing Boolean logic statements in combination with basic arithmetic to provide conditional mathematical computations.
 2. Passwords: The DDC/EMS shall have multiple levels of user programmable passwords in addition to a master password, for programming security. Separate passwords may be user programmed. Level of password will define user's access level and ability to change system.
 3. Trend Logging: The DDC/EMS shall trend log variables. Any system variable (inputs, outputs, numerals, can be trend logged).
 4. Messages: The DDC/EMS shall provide alarming, preventative maintenance and status reporting messages.
 5. Look Up Tables: The DDC/EMS shall have preprogrammed "LOOK UP" tables for the conversion of voltage inputs into dew point temperature and water vapor pressure values for the computation of relative humidity and enthalpy.
 6. Documentation Format: The programming language of the DDC/EMS shall be plain English based such that a printout of the control program shall serve as the primary documentation for the system.
 7. Micro Processor Integrity Checking: Each DDC/EMS microprocessor shall continuously monitor and check itself and produce error messages in the event of a malfunction.
 8. Data Plotting: The DDC/EMS shall provide plots of values of system variables on a graph. Graphs may consist of combinations of up to 3 system variables at a time from the history logs.
- E. Color Graphics Requirements Provide color graphics which allow user to access and change (based on user access level) all schedules and setpoints (including damper or control valve positions) directly through the user graphics. Real time data shall continuously be updated. Navigation between the screens (forward and backwards) shall

be accomplished with the use of a mouse. The minimum graphic screens shall include the following:

1. Site lay-out locations of all equipment being controlled, control component locations, and spaces served. Provide multiple screens-minimum of 1 screen per building plus site and others as needed for clarity. By "clicking" mouse on the desired equipment area a flow diagram will be displayed for the related equipment (as described below - Item 2). By "clicking" the mouse on a conditioned space, a graphic display of the zone conditions (as described below - Item 3) will be displayed.
 2. Flow diagrams shall be provided for each HVAC system, such as air-handling system, chilled water system, hot water system, condenser water system, package unit system, brine system with all inputs and outputs dynamically displayed.
 3. Each temperature control zone shall have a screen providing set points, temperatures, and related HVAC system status data.
 4. Scheduling screens allowing On/Off times to be set for all of the following:
 - a. Pre-determined individual days
 - b. Pre-determined blocks of days (From/To)
 - c. Schedules for "Routine" school sessions
 - d. Schedules for "Special" school sessions
- F. Software Manual: The software manual shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software feature. The manual shall instruct the user on programming or reprogramming any portion of the system. This shall include all control programs, variables, set points, time periods, messages, passwords and other information necessary to load, alter, test and execute the system. The manual shall include commands, editing and writing control programs, printouts and logs, mathematical calculations, and instructions on modifying any control point, verifying error status, changing passwords, and initiating or disabling control programs.
- G. Software Licenses: The owner shall be named the license holder of all software associated with any and all incremental work on the project(s). Owner shall receive ownership of all job-specific software configuration documentation, data files, and application-level software developed for this project. This shall include all custom, job-specific software code and documentation for all configuration and programming that is generated, and any related LAN/WAN/Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the Owner.

2.5 USER INTERFACE:

- A. Character Code: Communication with the DDC/EMS shall be ASCII format, or manufacturer's management communication program.
- B. External Communication Interface: In addition to the LAN/WAN communication capabilities specified in paragraph 1.3, C, each master unit shall communicate through an EIA RS232C serial port. Communication may be accomplished with any RS232C compatible terminal. Baud rate shall be selectable from 300 to 19.2 baud. The master shall also provide a spare RS232C serial port for communication to an alarm printer. The software shall provide the ability to direct alarm messages and text reports to either the District workstation and On-site workstation via the LAN/WAN, the spare port or the primary communication port based on time of day, type of alarm, etc.

- C. Direct Computer Communication: The DDC/EMS shall have a computer compatible communication mode for communication with other intelligent devices, which performs data integrity checking, with automatic retransmission of data when errors are detected.
- D. On-Campus Operator Workstation: Hardware shall be furnished by District. Install DDC/EMS software on workstation, and furnish Software license for workstation to District. Coordinate hardware requirements with District.
- E. Laptop Computer (Service Tool): Hardware shall be furnished by District. Install DDC/EMS software on laptop, and furnish Software license for workstation to District. Coordinate hardware requirements with District.

2.6 SYSTEM COMPONENTS:

- A. Control Components:
 - 1. Wall Switches: Plates for all wall switches and timers shall match those specified in Division 26.
 - 2. Labels: All labels, signs, etc. shall be engraved, laminated plastic, white on black background, 1/8" high lettering, minimum.
 - 3. Temperature Sensors:
 - a. Sensor Type: All temperature sensors shall be made of a highly stable, precision thermistor material accurate to within +/- 0.36 Degrees F. Identify each temperature sensor with a "Lamicoid" label keyed to the control system as-built drawings.
 - b. Room Sensor: Room temperature sensor shall have Executive Decorator housing with programmable visible temperature indication. Housing shall include an occupancy override, temperature setpoint adjustment and a service tool jack. Units as detailed on drawings shall have integral CO2 sensor similar to '4' below.
 - c. Vandal Resistant Room Sensor: Where noted, shall be a blank stainless steel wall plate with the sensing element bonded to the back side. The plate back shall be insulated to reduce wall temperature influence.
 - d. Duct Sensor: Duct temperature sensor shall be a probe type element with 9 inch insertion length. Element shall be installed where air mixture provides a true temperature indication. Where adequate mixing is not practical, the duct temperature sensor shall have an averaging type thermistor element, installed across the entire cross section of the duct.
 - e. Outdoor Air Sensor: Outdoor air temperature sensor shall be a probe type element mounted in a ventilated, treated white PVC sun shield to minimize radiant energy effects. The sensor and sun shield shall be mounted on a weatherproof outlet box for outdoor installation.
 - f. Low Differential Air Pressure Applications (0" to 5" W.C.): The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points. Non-interactive zero and span adjustments, adjustable from the outside cover. (0.00 - 1.00" to 5.00") W.C. input differential pressure ranges. 4-20 mA output. Maintain accuracy up to 20 to 1 ratio turndown. Reference Accuracy: +0.2% of full span.
 - 4. Carbon Dioxide Sensor: Wall mounted CO2 sensor, specially designed for demand controlled ventilation. Non-dispersive IR (NDIR) sensor. Five-year recommended calibration interval. Push-button calibration. Features as specified below. Kele KCD Series.
 - a. Range: 0-2000 ppm CO2
 - b. Accuracy +/- 3% of reading or ±40 ppm

- c. Response time: < 1 min.
 - d. Output signal: 0-10 VDC or 4-20 mA (500 ohm max) depending on model
 - e. Power supply: Nominal 24 VAC/DC
 - f. Warm-up time: 3 min.
 - g. Operating temp: 32° to 122°F (0° to 50°C)
 - h. Operating humidity: 0% to 95% RH (noncondensing)
- 5. Temperature Control Panels: Each panel and each control device or readout on the front of the panel shall be identified with a laminated plastic label with 1/4" high engraved lettering, white on black background. Pilot lights shall be the push to test type.
- 6. Smoke Detectors: Furnished and installed by Division 26. Power and fire alarm wiring by Division 28. Control wiring by Division 23. Coordinate with Division 26.
- 7. Status Sensor: Current sensing status sensor (with sensitivity adjustment for belt loss detection).
- 8. Control Valves:
 - a. General: Equal percentage or linear flow characteristics. Unless otherwise noted, select for 2-4 psi pressure drop across the valve at the specified flow. Belimo. 2" and smaller shall be screwed connection, globe or ball valve. 2-1/2" and larger shall be flanged connection globe valve.
 - b. Ball Valve: Stainless steel ball and stem, teflon seat and O-rings. 400 psi WOG. Packing shall be reinforced teflon seal washer and stuffing box ring. Stem packing gland screw shall be adjustable for wear. Factory flow characterization disk.
 - c. Globe Valve: Contoured plugs for linear control. 316 stainless steel stem, replaceable seat and adjustable operating range. Packing shall be molded BUNA-N. Valves controlling terminal units or above ceilings shall be of the packless type with bellow seal, or spring loaded teflon requiring no packing maintenance. 2" and Smaller: Bronze body, 250 psi WOG. 35 psi maximum working pressure differential. 2-1/2" and Larger: Cast iron body, 125 psi WOG. 25 psi maximum working pressure differential.
- 9. Electric Actuators:
 - a. General: Fully modulating, UL listed. Visual position indicator, manual override and clear weather shield where exposed to weather. 24 volt. Belimo.
 - b. Valve Actuators: Provide with factory mounting brackets and linkage to the control valve. Capable of shutting off against a 50 psi differential.
 - c. Damper Actuators: Positive position feedback and spring return. OSA dampers shall be spring return closed. Actuators shall be direct mounted onto the damper control shaft without linkage. Damper actuators shall be sized to provide a minimum of 5 in-lbs torque per square foot of damper face area.
- B. Lighting Contactors: Lighting contactor with metal enclosure will be furnished, installed, and wired to the lighting panel by the electrical contractor. See electrical contract documents for location. The DDC/EMS Contractor shall provide low voltage relay(s) required at the contactor panel and wire to the contactors to complete the DDC/EMS side of the lighting control. DDC/EMS Contractor shall provide required photo cells. Relays shall be suitable for up to 277 volts.
- C. Lightning Arrestor and Surge Suppressors: Shall be provided as approved and/or manufactured by the DDC/EMS equipment manufacturer.

- D. Conduit: Conduit to be a minimum 1" diameter, and to have at least 25% spare capacity, except drops to room sensors may be run in ½" conduit. Conduit shall be run in electrical or mechanical trenches wherever possible. Site conduit (building to building) will be installed (and terminated inside the building) by Division 26.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION:

- A. General: All electrical work shall be in accordance with the California Electrical Code and the Electrical Specification Sections. All electric/electronic systems shall be hardwired in conduit. Wiring shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed wiring shall run parallel to room surfaces; location shall be approved by the Architect. No structural member shall be weakened by cutting, notching, boring or otherwise. Provide a 120 volt circuit for each device requiring external power. Dedicated circuits shall be provided where required. Any devices or wiring exposed to the weather shall be protected in weatherproof enclosures such as NEMA 3R and weatherproof conduit.
- B. Labeling of System: DDC/EMS Contractor shall provide complete labeling of all terminals at all panels or equipment terminal strips and wiring. Equal to Brady marking on wires and number on terminals in sequence corresponding to control diagram.
- C. Programming:
 - 1. The Direct Digital Control and Energy Management System (DDC/EMS) operational program shall be provided by the DDC/EMS Contractor. The DDC/EMS Contractor shall be responsible for programming the system and shall coordinate the scheduling (on/off times) with the Owner. Prior to start-up, the DDC/EMS Contractor shall provide any testing program he feels necessary to fully test the operation of the various components.
 - 2. The DDC/EMS Contractor shall load the operational program into the DDC/EMS controller from his office via the system's modem or at the job site via a direct connect cable. Prior to starting up the system, the DDC/EMS Contractor shall:
 - a. Confirm that the control system has been connected to the District's LAN/WAN, a dedicated telephone line, and that the LAN/Wan and the phone line and system modem is working.
 - b. Confirm the functionality of the DDC/EMS controllers and all input points by reading the input values, and comparing them with a measured temperature, pressure, voltage, current, or resistance as appropriate. Calibrate all transducers as required.
 - c. Confirm the functionality of all digital output points by manual operational of the relay contacts. Use proper discretion in starting and stopping equipment.
 - d. Confirm the functionality of all analog output points by manually imposing an adjustable voltage on the appropriate circuit to check proper operation of the controlled device. Calibrate all transducers as required.
 - e. The DDC/EMS Contractor shall notify the General Contractor (one week in advance of) when the system will be ready for loading and testing the operational program. The DDC/EMS Contractor's start-up technician shall be present while the program is being loaded and shall communicate with the programmer prior and after program loading to confirm proper operation.

- D. Training: Prior to final acceptance, the DDC/EMS Contractor shall provide operational training to the Owner's personnel. The training sessions shall include a complete demonstration of the system. Dates and times of the training sessions shall be coordinated through the Owner not less than one week prior to session. A total of 40 hours of instruction shall be provided - 24 hours initially, and 16 hours to be spread throughout the first year of operation. The DDC/EMS Contractor shall maintain a log of training sessions including dates, times and names/titles of those attending. The DDC/EMS Contractor shall submit a copy of this log on request.
- E. Testing and Acceptance: The DDC/EMS Contractor shall furnish a complete and operating system. The DDC/EMS Contractor shall also verify, in the presence of the Owner, the system accuracy and proper function of each controlled device and sensor. The following items shall be successfully demonstrated prior to acceptance by the Owner:
1. All system outputs including controllers, relays, and other control devices shall be addressed and start/stop functions demonstrated.
 2. All inputs shall be displayed and all event-initiated functions shall be demonstrated.
 3. Demonstrate program integrity and power restore sequence during and after a power failure and restoration.
 4. Deliver all Record Drawings, wiring diagrams, equipment specifications, installation and Operation Manuals and other documentation as required to describe the system.
 5. Complete operator training in the use, programming, and operation of the system.
- F. Start-up of the System:
1. The start-up period starts when the following conditions are met:
 - a. The DDC/EMS system and all involved HVAC equipment have been installed, connected to the DDC/EMS system and are ready to operate.
 - b. A start-up meeting has been conducted with representative of the General Contractor, Architect/Engineer, maintenance staff, and the DDC/EMS Contractor.
 - c. Consensus is reached, by the representatives at the above referenced meeting that it is appropriate for the start-up process to start.
 2. The alarm pagers called by the control system during the start-up period shall be the pagers carried by the Mechanical Contractor and/or DDC/EMS Contractor as appropriate. The Mechanical Contractor and DDC/EMS Contractor shall respond to all pages from the control system and work cooperatively to insure that the building environmental standards are maintained.
 3. The start-up process shall be completed and the warranty period shall start when the following conditions are met.
 - a. All training to be provided as part of the project has been completed.
 - b. No "alarm" or "condition reports" are being generated by the DDC/EMS system for seven (7) calendar days (168 hours) due to incomplete or inaccurate installation or programming.
 - c. All adjustments and "fine tuning" of the system have been completed.
 - d. The phone numbers for the pagers and alarm printer are programmed.
- G. Verification: A written testing and start-up report must be submitted for approval before acceptance. In addition to the DDC/EMS Contractor's testing and start-up report, the Owner may independently verify the test results. The report on test results shall include setpoints and operating ranges of all components.

3.2 SEQUENCE OF OPERATION:

- A. Heating/Cooling Unit and Split System Air Conditioner: (Heating setpoint 72°F, Cooling setpoint 75°F) The unit shall run per the system operation schedule through the DDC/EMS. Room temperature sensor shall be wall mounted. If the bypass button on the room temperature sensor is activated, the heating/cooling unit shall start for two hours (adj.). The unit setpoint shall be adjustable $\pm 2^{\circ}\text{F}$ (adj.) from a switch located on the temperature sensor. Unit fan shall run continuously on start by the DDC/EMS. DDC/EMS shall control the heating/cooling unit to maintain setpoints. On call for cooling, the DDC/EMS shall start the unit cooling at 2°F (adj.) above cooling setpoint and run to 2°F (adj.) below setpoint for cooling and then stop the unit cooling. On call for heating, the DDC/EMS shall start the unit heating at 2°F (adj.) below heating setpoint and run to 2°F (adj.) above setpoint for heating and then stop the unit heating. The unit shall be capable of economizer operation. The DDC/EMS shall monitor the unit status with a current sensor and the supply air temperature. A factory furnished static pressure sensor shall be installed in the ceiling to control the power exhauster to maintain a 0.05" W.C. (adj.) setpoint when unit is in economizer operation. Provide a co-axial cable switch plate cover for mounting the room pressure sensing port.
- B. Split System Air Conditioner (ODU/IDU-1A, 1B,1C): (Heating setpoint 72°F, Cooling setpoint 75°F) System operation shall be controlled by a factory furnished controller to be mounted on the wall. The control contractor shall provide the interlock wiring between the controller and the indoor unit, and the interlock wiring between the indoor and outdoor unit. Power wiring between the outdoor unit and indoor unit shall be by others. A wall mounted temperature sensor next to the controller shall monitor room temperature. DDC/EMS shall monitor system status with current sensors (one each for ODU and IDU). On unit failure, the DDC/EMS shall indicate a unit failure alarm.
- C. Split System Air Conditioner (ODU/IDU-2,3): Similar to paragraph B above, except units are enabled continuously (process cooling).
- D. Energy Recovery Ventilator (ERV): Shall be interlocked to run with ODU/IDU-1A, 1B, 1C.
- E. Exhaust Fan: DDC/EMS shall start/stop fan per schedule by Owner, unless noted otherwise on equipment schedule. A current sensor shall monitor fan status to the DDC/EMS. If the exhaust fan is to be running and the current sensor indicates that the fan is not running, the DDC/EMS shall signal an exhaust fan failure.
- F. Ceiling Fan: Similar to Exhaust Fan Above, except interface with factory BACnet fan controller.
- G. Domestic Hot Water Circulating Pumps: DDC/EMS shall start/stop all domestic hot water circulating pumps on a schedule established by the Owner. DDC/EMS shall monitor status of each pump with a current sensor.
- H. Outside Lighting: Outside lighting points currently controlled by DDC/EMS shall remain. Provide additional points, if required by the Electrical Drawings. Coordinate with Division 26.
- I. Minimum Outside Air Reset (For Units as Scheduled on Drawings): A wall mounted CO₂ sensor shall control the air handler system outside air damper when the system is in the Heating or Cooling modes to reset the minimum outside airflow. The CO₂ sensor set points and the outside air damper set points shall be developed in coordination with the Balance Contractor.

1. CO₂ Sensor Set Points: The Control Contractor shall determine the base ambient CO₂ concentration level after the air handler system has been balanced and the building is unoccupied. The upper and lower CO₂ concentration set points shall be developed as follows:
The lower CO₂ concentration set point shall be 200 ppm (adj.) above the base ambient CO₂ concentration level.
The upper CO₂ concentration set point shall be 500 ppm (adj.) above the base ambient CO₂ concentration level.
2. Outside Air Damper Minimum Airflow Set Points: The Control Contractor shall set the outside air damper position airflow set points for the upper and lower CO₂ concentration set points as follows:

	Lower CO ₂	Upper CO ₂
	Concentration OSA	Concentration OSA
	Damper Position	Damper Position
<u>Units</u>	<u>Airflow Set Point</u>	<u>Airflow Set Point</u>
As Scheduled	As Scheduled	As Scheduled
3. Outside Air Damper Control: The DDC / EMS shall monitor the CO₂ concentration every 5 minutes while the unit is on. On system startup, the outside air damper shall open to the lower damper position set point. If the CO₂ concentration is above the upper CO₂ set point, the damper shall open by 20% of the range between the upper and lower damper positions. The damper shall not open more than the upper position set point if the air handler is not in the Ventilation mode. If the CO₂ concentration is below the lower CO₂ set point, the damper shall close by 20% of the range between the upper and lower damper positions. The damper shall not close more than the lower position set point.

END OF SECTION 23 09 23

SECTION 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. All work under Divisions 26, 27, and 28 is subject to the General, Supplementary, Special Conditions and other Division 1 Specification Sections preceding this section. The Contractor will be responsible for and governed by all requirements. Drawings indicate the general arrangement of the electrical layout and work included. The Contractor will follow these drawings to lay out and check the drawings of other trades to verify locations and spaces in which work will be installed.

1.2 SUMMARY OF WORK

- A. This portion of the work includes furnishing of all labor and materials necessary for a complete wiring system to outlets and all equipment shown on the Drawings or covered by this section of the Specifications. In general, the work includes the following:
1. Utility services and facilities as detailed on the Plans, including the defrayal of the utility installation charges.
 2. Power service and distribution system as shown, complete with switchboards, panelboards, feeders and motor control centers.
 3. Complete system of branch circuit wiring and equipment including all wiring devices and plates on all outlets.
 4. A new lighting fixture system complete with lighting controls, as shown on Plans, including factory commissioning and acceptance testing.
 5. Telephone, public address, security, data and fire alarm systems, including conductors, cable, and equipment, for complete working systems. Each system shall be terminated, tested, calibrated, and programmed by a factory authorized installer. The same installer shall terminate and test any peripheral equipment required for the operation of the system.
 6. Raceways, wiring, fused disconnect switches, etc., for equipment covered by other sections of these Specifications.
 7. All hangers, anchors, sleeves, chases and supports for fixtures, electrical equipment and materials including earthquake bracing.
 8. All excavating, backfill, concrete pads and bases as required for electrical work.
 9. All disconnection and removal of existing electrical facilities not to be reused or noted to be demolished.
 10. Include payment of all required insurances, electrical permits, fees and taxes unless specifically shown "BY OTHERS".
- B. The electrical drawings are diagrammatic and do not necessarily show all raceway, wiring, number or types of fittings, offsets, bends or exact locations of items required by the electrical systems. Items not shown or indicated which are clearly necessary for proper operation, payment or installation of systems shown shall be provided at no-increase in contract price.
- C. The exact routing of systems and location of devices and equipment shall be governed by coordination with other trades, structural and architectural conditions. The Architect or Electrical Engineer reserves the right, at no increase in contract price, to make reasonable changes in location of electrical equipment or wiring systems; so as to coordinate with other systems, group them into orderly relationships, or to increase their utility. Contractor shall verify requirements in this regard prior to roughing in.

- D. Install electrical work in cooperation with other trades and make proper provisions to avoid interferences and coordinate with structural and architectural features, in a manner approved by the Architect or Electrical Engineer. All changes caused by neglect to make such provisions shall be at Contractor's expense. Provide offsets and special fittings, as required to facilitate installation of the work.
- E. When a particular product or type of product is specified with a manufacturer's designation, the latest published specifications, installation, and construction information of the manufacturer shall constitute the minimum acceptable standard. Any substitutions shall be made in accordance with the SUBSTITUTIONS sections of the Specifications.

1.4 RULES AND REGULATIONS

- F. All work and materials shall be in full accordance with the latest rules and regulations of the following:
 - 1. California Electrical Code (CEC), 2022 Edition
 - 2. California Energy Commission, Title 24, 2022 Standards
 - 3. California Fire Code, 2022 Editions
 - 4. National Fire Alarm and Signaling Code NFPA 72, 2022 Edition
 - 5. California Building, Mechanical and Plumbing Codes, 2022 Editions
 - 6. California Code of Regulations
 - a.) Title 8, Safety Orders
 - b.) Title 19, Fire and Panic Safety Standard
 - c.) Title 24, Part 1, Administrative Regulations
 - 7. Occupational Health and Safety Act (OSHA)
 - 8. California State Fire Marshal Rules
- G. Where two or more codes conflict, the most restrictive shall apply.
- H. Nothing in these Plans and Specifications is to be construed to permit work not conforming to these codes.
- I. Before the Final Certificate of Payment will be issued, the Contractor shall deliver to the Owner all Certificates, Permits, Record Drawings and Instructions/Parts Manuals.

1.3 TESTS AND STANDARDS

- A. The tests, standards, or recommended procedures of the following agencies shall relate to all parts of these Specifications and shall be considered a minimum:
 - 1. American National Standards Institute (ANSI).
 - 2. Underwriters Laboratories, Inc. (UL).
 - 3. National Electric Manufacturers Association (NEMA).
 - 4. Electrical Testing Laboratories (ETL).
 - 5. National Fire Protection Association (NFPA).
 - 6. Insulated Power Cable Engineers Association (IPCEA).
 - 7. Institute of Electrical and Electronic Engineers (IEEE).
 - 8. Illumination Engineering Society (IES).

1.4 EXAMINATION OF DOCUMENTS AND SITE

- A. Before submitting a proposal, each bidder shall carefully examine the electrical, mechanical, architectural, and structural drawings and specifications. He shall also visit the site and fully inform himself as to all existing conditions and limitations applying to the work. If, after such examination and study, it appears that any change from the drawings and specifications should be allowed, the bidder shall so state in writing together with any change in cost

involved.

- B. By the act of submitting a proposal, each bidder shall be deemed to have made such examinations of the drawings and specifications and premises, and it will be assumed that he is therefore familiar with the entire scope of the project and has based his proposal upon the work described in the Drawings and Specifications and upon all existing conditions and limitations applying to his work.

1.5 7 IMPLEMENTATION

- A. Workmanship: The work shall be performed by competent workmen, skilled in the particular phase of the work entailed. The work shall be first class throughout, neat, accurate and in full accordance with the intent of these Specifications and the satisfaction of the Architect or Electrical Engineer.
- B. Safety: All standard safety procedures as set forth by OSHA, CCR, and California Division of Industrial Safety shall be strictly adhered to.
- C. Coordination: The Contractor shall familiarize himself with the work of other crafts so as to be able to provide electrical service of correct size and voltage and other requirements to any equipment to be installed.
- D. Scheduling: The installations shall be coordinated as to location and time, and interference causing delays and non-acceptable construction shall be avoided. Order equipment in a timely manner to prevent any delays in the construction schedule and he shall bear any penalty by vendors to meet schedules.
- E. Collaboration: Prior to commencing construction the Electrical Contractor shall arrange a conference with the general and sub-contractors as well as equipment suppliers and shall verify types, sizes, locations, requirements, controls, and diagrams of all equipment furnished by them.
- F. Materials: All equipment and materials shall be new, UL (Underwriters Laboratories) approved, and of the best quality. When specific trade names are used in connection with materials they are mentioned as standards but, this implies no right upon the part of the Contractor to substitute other materials or methods without prior approval.
- G. Excavation: The Contractor shall provide all excavating and backfill required for the proper installation of electrical work, whether or not shown on the Drawings or as specified. This shall be done per the EXCAVATION portion of the Specifications.
- H. Cutting and Repairing: The Electrical Contractor shall do all cutting necessary for the proper installation of his work, repair any damage done by himself or his workmen, and coordinate his work with that of others. Do no cutting or patching without approval of the Architect or Electrical Engineer. Round holes through concrete slabs or walls shall be core drilled with a diamond drill, rectangular openings shall be cut with a diamond saw. In no case shall any concrete beam or column be cut.
- I. Sleeves and Openings: Electrical Contractor shall be responsible for all sleeves and openings through walls and floors required by electrical work. All openings around conduits in sleeves shall be sealed with a material of equal fire rating as the surface penetrated. Openings not utilized shall be temporarily sealed in a similar manner. All required sleeves shall be furnished to and coordinated with the General Contractor.
- J. Cleaning and Painting: All exposed work shall be thoroughly cleaned upon completion of

work. All panelboards and equipment not located in electrical or mechanical rooms or closets shall be field painted per painting specifications, color as selected by Architect. Panelboard enclosures, fixtures, and equipment, where finish has been marred in shipment or installation, shall be completely refinished. Minor finish damage shall be rectified as indicated by the Architect or Electrical Engineer. Contractor shall remove all waste and rubbish resulting from his work from the site.

- K. Earthquake Restraint: All electrical equipment shall have a means to prohibit excessive motion during an earthquake. Equipment that vibrates during normal operation shall have isolators with mechanical stops. All transformers are considered to vibrate during operation. All electrical equipment and connections shall be designed to resist lateral seismic forces equal to value shown on Drawings of equipment weight with allowable working code capacity increased by 1/3 or 1.5 times the same value for the weight yield capacity. Connections shall be the same except the 1/3 increase will not be allowed.
- L. Mechanical Equipment and Other Special Equipment:
 - 1. Prior to commencing construction, the Contractor shall arrange a conference with the Mechanical and Plumbing Contractors, and the Equipment Suppliers, to verify type, sizes, locations, requirements, controls and diagrams of all equipment furnished by them. In writing, he shall inform the Electrical Engineer that all phases of coordination of this equipment have been covered. If any unusual conditions or problems arise, they are to be enumerated them at this time.
 - 2. The Contractor shall furnish all electrical line voltage wiring, fused disconnects and conduits, unless otherwise shown.
 - 3. The Contractor shall be responsible for electrical hook-up and connection to all electrical equipment furnished by all Contractors of this Project. This includes all mechanical equipment, plumbing equipment, and special equipment furnished by other contractors.
- M. Portable and Detachable Parts: The Contractor shall retain in his possession and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of his work. These parts shall be itemized and delivered to the Owner at Project Closeout.

1.6 QUALITY CONTROL

- A. Supervision: The Contractor shall personally, or through a competent representative, constantly supervise the work from beginning to completion and final acceptance. He shall cooperate fully with the inspection authorities in the provision of information and access to the work. He shall, to the best of his ability, maintain the same job foreman throughout the life of the project unless a replacement is requested or authorized by the Architect or Electrical Engineer.
- B. Inspection and Tests: The Contractor shall furnish all labor and test equipment required to fully test and adjust the equipment installed under this specification and demonstrate its proper operation.
 - 1. Arrange for all tests and inspections and provide minimum 48 hours' notice to the Architect or Electrical Engineer.
 - 2. A test must demonstrate that each piece of equipment, outlet, fixture, device, and appurtenance is in sound operating condition and in proper cooperative relation to associated equipment.
 - 3. All tests shall be conducted under supervision of the Architect or Electrical Engineer, and any defects of any nature which are apparent as a result of such test shall be made correct to the satisfaction of the Architect or Electrical Engineer before final acceptance is made.
 - 4. No equipment shall be tested, or operated for any other purpose, such as checking

motor rotation, until it has been fully checked in accordance with the manufacturer's instructions.

- C. Warranty: The Contractor agrees to replace or repair, to the satisfaction of the Owner, any part of the installation which may fail due to defective material and/or workmanship or failure to follow Drawings and Specifications, for a period of one year after final acceptance. Any damage to other work resulting from such failure or the correction thereof shall be remedied at the Contractor's expense. The Contractor shall, further, secure from the manufacturers of special equipment, such as signal systems, their respective guarantees and deliver same to Owner. Guarantees between Contractor and his suppliers shall not affect warranties between Contractor and Owner.

1.7 SUBMITTAL

- A. Make submittal for all material to be used on the project, whether as specified or substitutions, within thirty five (35) days after award of Contract by the Owner, in accordance with Section 01-300, SUBMITTAL, and the following:
1. All submittal shall be neat and bound in a suitable folder or binder.
 2. Identify each item by manufacturer, brand, trade, name, number, size, rating, and whatever other data is necessary to properly identify and check materials and equipment. Words "as specified" are not sufficient identification.
 3. Identify each submittal item by reference to specifications section paragraph in which item is specified, or Drawings and Detail Number.
 4. All submittal shall be submitted in coherent groups, e.g. all light fixtures at one time. No partial, or incomplete submittal will be accepted.
 5. Organize submittal in same sequence as they appear in specification sections, articles or paragraphs.
- B. Product Data: Submit eight copies, in groups, as follows:
1. Boxes, pullboxes, conduits, and raceway types required, including fittings
 2. Electric Wire, cable and connectors
 3. Circuit breakers, Panelboards, Transformers, and disconnects.
 4. Lighting fixtures
 5. Wiring Devices
 6. Special System Equipment
- C. Shop Drawings: Shop drawings shall show physical arrangement, wiring diagram, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, weight, power sources, circuit numbers, and shall be compatible with the Contract Drawings and Specifications.
- D. Show wiring as actually installed, connected, and identified for this specific project. Include identification of cables and cable conductors.
- E. Shop and instruction drawings shall cover the equipment or device to be installed and not merely the general class of such equipment or device.

1.8 SUBSTITUTIONS

- A. The Specifications or Drawings are in no way to be construed as being proprietary toward one product. Those products, or types of products, listed are intended to set the standard for quality, design, and installation procedure. However, no right is implied upon the part of the Contractor to substitute other materials, products or systems without the written approval of the Architect or Engineer.

- B. All requests for substitution shall be made in accordance with the SUBSTITUTIONS section of the Specifications.
- C. All requests for substitutions shall be in writing, received at least 14 days prior to bid date, and shall indicate all information required thereon including differences from the specified item. The request for substitution shall be accompanied by cuts, product literature, performance data, specifications, drawings, samples or other means as may be required for proper evaluation by the Architect or Electrical Engineer.
- D. All proposed substitutions shall be standard product of the firm under current manufacture and be a catalog item at time of bid.
- E. Acceptance of substitution shall not relieve the Contractor from responsibility for complying with requirements of the Contract Documents. The Contractor shall be responsible for changes in other parts of the work occasioned by his substitutions and shall bear their expense.
- F. Representative samples may be required for determination of equality. It is understood that the samples may be subjected to destructive testing and will not be returned.

1.5 GUARANTEE

This Contractor agrees to replace or repair to the satisfaction of the Owner, any part of the installation that may fail due to defective material and/or workmanship, or failure to follow Plans and Specifications for one year after final acceptance. He shall further obtain from the manufacturers of special equipment (i.e., control systems) their respective guarantees and service manuals and deliver to Owner.

1.6 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

The Engineer's decision will be final on interpretation of the Drawings and Specifications. Whenever "AS MAY BE DIRECTED", "SUITABLE", "APPROVED EQUAL", "AS REQUIRED", or other words of similar intent and meaning are used which infer that judgment is to be exercised, it is understood that it is the judgment of the Engineer being referred to.

PART 2 PRODUCTS

2.1 RACEWAYS:

- A. Except where specifically shown otherwise in this section, the Contractor shall furnish and install a complete steel, rigid thread galvanized rigid steel conduit system for all wiring, including control and signal wiring.
- B. Galvanized Rigid Steel (GRS)
 - 1. All conduits shall be rigid threaded hot dipped galvanized type.
 - 2. Joints are to be sealed with conductive pipe compound T&B "Kopr-Shield" before making up.
 - 3. Conduits installed below grade shall be wrapped with 3M "Scotchrap #51" corrosion protection tape using half-laps for double thickness. Conduit surfaces are to be clean and dry before wrapping.
- C. Steel Electrical Metal Tubing (EMT)
 - 1. EMT may be used within the hollow dry spaces of buildings, minimum 96" above the finished floor. Trade sizes 4" and smaller may be used within hollow dry spaces of the building.

2. EMT conduit shall be Allied True Color E-Z Pull, or equal, with a colored finish specific to the following systems:
 - a.) Natural: 0-150V-to-Ground Power & Lighting
 - b.) Yellow: 150V-to-Ground Power and Lighting
 - c.) Blue: Copper Data & Communications
 - d.) Orange: Fiber Optic Cable
 - e.) Red: Fire Alarm
 3. All raceway fittings, locknuts, couplings, elbows, etc., shall be hot dipped galvanized steel finish with plastic throats or bushings. Cast-type fittings shall not be used.
- D. Non-Metallic Polyvinylchloride Conduit (PVC):
1. Rigid nonmetallic PVC, UL labeled and fittings approved for the purpose may be used for electrical systems 0-600V-to-ground under the following conditions:

All conduits in earth under buildings or protected by permanent paving may be Schedule 40 PVC. Any conduits running through planters or unprotected are to be encased in 3" of concrete. All raceways above grade are to be steel.

Risers shall be blue color, factory PVC coated T&B "Ocal" steel ells. Bends less than 45 degrees and offsets may be field bent.
 2. All nonmetallic runs shall have a bond wire for the interconnecting of all conducting portions per Article 250 of the California Electric Code.
 3. PVC shall never be used above grade.
- E. Liquid-Tight Flexible Metal Conduit (LFMC):
- LMFC may be used in lengths not greater than 36" at motors and other machinery to prevent the transmission of vibration. LFMC shall be supported at both ends.
- F. Surface raceways and fastenings are to be two-piece steel type, complete with all fittings of the same manufacturer and factory finished in gray. Surface plug-in strips shall be two circuit type with NEMA grounded receptacles every 12" with wiring space provided.
- G. The minimum size conduit for lighting, power, and signal wiring shall be 3/4" trade size.
- H. Conduits installed underground shall have a minimum coverage of 24" below a finished grade. Provide a magnetically traceable warning tape at 12" below grade. Electrical systems rated greater than 150V to Ground shall have a 3" concrete envelope.

2.2 CONDUCTORS:

- A. All conductors shall arrive to the project in their original, unbroken packages plainly marked as follows:
1. Packaging shall indicated underwriter's labels, size, conductor material, insulation of wire, names of the manufacturer and the trade name of the wire.
 2. Wire or cable shall have factory markings every 24". Markings shall show its maximum allowable voltage, wire size and insulation.
- B. All conductors shall be a minimum of 98% conductivity, soft drawn copper, minimum #12 AWG unless shown otherwise. Conductors sized #8 and larger shall be stranded. Conductors sized #10 and smaller shall be solid type, except wiring within fixtures. Insulation shall be 600 Volt, type "THWN."
- C. Control circuits for mechanical equipment in locations subject to abnormal temperatures on or under furnaces and heaters shall be Type "RHH" 600 Volt insulation conductors.
- D. All branch circuits, fixture wiring joints, splices and taps for conductors #10 and smaller to be made with "Scotchlok" connectors.

- E. Two-bolt type solderless connectors or T&B "ColorKeyed" compression lugs shall be used on #8 and larger conductors.

2.3 3 WIRING DEVICES:

- A. Furnish and install wiring devices and plates as shown on the Drawings and described in these Specifications. Where more than one wiring device is mounted in the same location, such devices shall be mounted in a multi-gang plate. Wiring devices shall be specification grade or better.
- B. Wiring devices shall be of the color selected by the Architect.
- C. Convenience outlets to consist of a specification grade duplex receptacle mounted in an outlet box in the wall, flush with the finished plaster or surface. Outlet rating to be 20 AMPS, 125 Volts, 3-wire, back and side wired.
- D. All outlets shown outdoors or in damp locations shall be GFI type, installed in a weatherproof box and cover equipped with rubber gaskets. Surface outlets shall be weatherproof type FS boxes with hubs as required and equipped with rubber gaskets and weatherproof covers.
- E. Local switches shall be quiet toggle type, totally enclosed, 20 AMPS, 277 Volts AC rated.
- F. Device plates shall be provided for all devices with the number of gangs and openings necessary. They shall be satin brushed 302 stainless steel, unless specified otherwise.
- G. Switch plates for all outlets not in sight of a switch shall be labeled with filled etched letters showing locations of the outlet controlled.
- H. Pilot lights shall be the type with an indicating neon lamp in a handle.

2.4 OUTLET BOXES:

- A. Outlet boxes for concealed work shall be one piece pressed steel knock-out type with zinc or cadmium coating. Boxes shall not be smaller than 4" square nominal size unless otherwise indicated. Provide extension rings, extenders, plaster rings and covers necessary for flush finish. No back-to-back or through-boxes shall be used.
- B. Bar hangers shall be used to support outlet boxes in stud or furred partitions and ceilings. Attachment screws, devices, etc., shall be of the proper type to secure boxes to metal studs. Use expansion shields in concrete and masonry. Where used for lighting fixtures, outlet boxes shall be equipped with fixture studs.
- C. Provide approved knock-out seals on all unused open knock-out holes.
- D. Outlet boxes installed in concrete slabs shall be two-piece concrete boxes, not less than 4" nominal size with a minimum depth of 2 ½".
- E. Surface boxes of cast metal threaded hub-type with suitable gasketed covers shall be used for exposed conduit runs less than 5' above finished floor, or where waterproof boxes are required.

2.5 PULL BOXES AND WIREWAYS:

- A. Pull and junction boxes shall be installed as shown to ease the pulling of wire and to comply with CEC requirements.

- B. Wireways shall be constructed in accordance with UL 870 for wireways, auxiliary gutters and associated fittings. Every component, including lengths, connectors, and fittings, shall be UL listed.

2.6 TERMINAL CABINETS AND CLOSETS:

- A. Cabinets and fronts shall be in accordance with NEMA Standard Publication No. PB 1-1971 and UL Standard No. 67. Fronts shall include doors and have flush brushed stainless steel, cylinder tumbler-type locks with catches and spring loaded door pulls. The flush lock shall not protrude beyond the front of the door. All locks shall be keyed like the panelboard locks. Fronts are to be adjustable indicating trim clamps that shall be completely concealed when the doors are closed.
- B. Doors shall be mounted by completely concealed steel hinges. Fronts shall not be removable with the door in the locked position. A frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge full finish steel with rust inhibiting primer and baked enamel finish.
- C. Install finish grade 3/4" plywood board, primed and painted light gray on both sides and the edges, at the interior rear surface of telephone and signal cabinets.
- D. Provide solderless box lugs, terminal blocks with a white marking strip for conductors sized #16 and larger. Punch-down terminals shall be used for No. 18 and smaller and shall be used for all public address, intercom and other electrical terminations.

2.7 FLOOR BOXES AND UNDERFLOOR DUCTS:

- A. Provide fully adjustable Type 1, Class 1 watertight floor boxes complete with pedestal and wiring device where shown on Plans.
- B. Furnish and install a complete duct system as shown on Plans. The system shall consist of separate ducts: No. 2 duct for electrical power service; No. 4 duct for telephone; No. 4 duct for data. Ducts shall have 2" inserts on 24" centers. Furnish and install the necessary junction boxes, couplings, supports, adapters, etc., to form a complete assembly made watertight with sealing compound.
- C. Ducts and junction boxes shall be manufactured from 14 gauge steel. They shall be UL listed and finished with a corrosion resistant coating. The junction boxes must be furnished with the proper depth to accommodate floor finish. Junction box cover plates to have an upward adjustment of 3/8". Cover plates must be leveled flush with the finished cement floor before and after the concrete has hardened.
- D. Furnish and install, where shown, telephone, data and power service fittings. All service fittings shall be furnished with receptacles, adapters and no spin locking nipples or supports.
- E. Fittings for floor boxes or ducts shall be brushed aluminum finish.
- F. Provide carpet flanges of proper size in carpeted or tiled areas.

2.8 PANELBOARDS:

- A. Furnish panelboards shown on Plans and described herein. All cans shall be a minimum of 20" wide and 5.75" deep unless otherwise shown. They shall be totally flat or equal with flush keyed locks.

- B. Panelboards shall be listed by Underwriters Laboratories, Inc.
- C. Fronts are to be sheet steel painted standard gray over a rust inhibitor. They shall be equipped with a door, flush hinges, flushed proper cylinder, tumbler-lock metal circuit card holder, and quarter turn adjustable trim clamps.
- D. Panels shall consist of a reinforced galvanized sheet steel frame with copper bus bars and circuit breakers properly supported to prevent vibration breakage in handling. All terminals shall be solderless type, suitable for specified conductors of sizes shown. Bus bars shall be sequenced phased. Provide separate blocks for neutrals and grounds.
- E. Branch circuit breakers shall be "bolt-on" and fully interchangeable without disturbing adjacent units. All two and three-pole breakers shall have common trips. Minimum IC shall be 10,000 AIC.
- F. Breakers used for switching lights shall be rated for switching duty and shall have padlock handle lock-off devices.
- G. Breakers serving mechanical equipment shall be rated HACR.
- H. All spaces shall have hardware.

2.9 MOTOR CONTROL CENTERS

- A. Furnish and install line voltage starters, RVSSs, or VFDs as required or shown on the Drawings. Furnish line connections only for integrally wired equipment furnished and installed by other sections. All starters, whether separate or mounted in Motor Control Centers, shall be furnished complete with stop/start pushbuttons, hand-off-auto switches, and two push-to-test pilot lights unless otherwise noted. They shall be in the proper NEMA enclosure.

2.10 MAGNETIC MOTOR STARTERS

- A. Magnetic motor starters, unless otherwise shown, shall be size 1 minimum, AC line voltage, HP rated across-the-line voltage in proper NEMA enclosure. They shall be equipped with three properly sized overload elements. Magnetic starters shall be listed by Underwriters Laboratories, Inc.
- B. Verify the exact motor current and voltage characteristics with the Contractor supplying the motor before installation of a starter.
- C. All magnetic starters to have a minimum of two auxiliary convertible contacts. Additional auxiliary contacts shall be provided as required to comply with the wiring diagrams of the electrical and mechanical requirements.
- D. Manual motor starters shall be flush or surface mounting type as required with number of poles and properly sized overload heaters as required for the motor being controlled. Where pilot light is called for with a starter, the pilot light shall be mounted in a separate adjacent box.
- E. Individual control relays shall have convertible contacts rated a minimum of 15 amps, 600 volts, regardless of usage voltage. Coil voltage and number and type of contacts shall be verified and supplied to suit the specific usage as shown in the wiring diagram and/or schedules on the electrical and mechanical drawings. Furnish in a proper NEMA enclosure.

2.11 DISCONNECTING DEVICES:

- A. Disconnecting devices shall be provided as shown or as required by CEC. Switches shall be motor rated and in proper NEMA enclosure.
- B. Motors 1/3 HP and less: Switches shall be the toggle-type quick make and break rated 2 HP, 250 Volts AC with the number of poles required provided with flush mounting wall plates or in suitable surface mounting NEMA enclosures.
- C. Motors 1/2 HP and larger: Disconnecting switches shall be Type HD fused multi-pole 600 Volts in proper NEMA enclosures with proper size FRS fuses. Provide three spare fuses of each type to the owner.
- D. Circuit breakers utilized as disconnecting devices must comply with the requirements stated in other articles of this section and CEC.

2.12 CONCRETE PADS, PULL HOLES AND MANHOLES:

- A. At the Contractor's option, he shall provide cast-in-place or precast structures.
- B. Where applicable, concrete structures shall be submitted to the serving utility for their approval before installation.
- C. Cast-in-place concrete shall be per the concrete section of the Specifications.
- D. Provide 8" concrete pads under all exterior switchboards, transformers, etc.

2.13 NOISE CONTROL:

- A. Outlet boxes at opposite sides of partitions shall not be placed back-to-back or through-boxes employed except where specifically permitted on the Drawings by note to reduce transmission of noise between occupied spaces.
- B. Contactors, starters, and similar noise-producing devices shall not be placed on walls that are common to occupied spaces unless specifically called for on the Drawings. Where such devices must be mounted on walls common to occupied spaces, they shall be shock mounted or isolated in such a manner to effectively prevent the transmission of their inherent noise to the occupied space.
- C. Contactors, starters, drivers, and like equipment found noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced at Engineer's request.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL:

- A. The layout and installation of electrical work shall be coordinated with the overall construction schedule to prevent delay in completion of the project. Checking these Drawings before organizing the electrical work schedule or installing material and equipment shall be obligatory.
- B. Dimensions and information regarding accurate locations of equipment and structural limitations and finish shall be verified with other sections.

- C. The Drawings do not show all the offsets, bends, special fittings, junction boxes, or pull boxes necessary to meet job conditions and the CEC. They shall be provided as required.
- D. Electrical equipment, outlets, junction and pull boxes shall be installed in accessible locations avoiding obstructions, preserving headroom and keeping openings and passageways clear.
- E. Minor adjustments in the locations of equipment shall be made where necessary, providing such adjustments do not adversely affect function of the equipment. Major adjustments for the location of equipment shall be approved by the Architect and detailed on the Record Drawings.
- F. Structural Fittings: Furnish and install the necessary sleeved, inserts, hangers, anchor bolts and related structural items. Install at the proper time.
- G. Openings have been shown on the Architectural and Structural Drawings. Should any additional openings or holes be required for the work of this section, the cost shall be the obligation of this section.
- H. Contractors shall inspect and account for existing conditions affecting his work.
- I. Sleeves for electrical conduits passing through walls or slabs shall be placed under the work of this section before concrete is poured. Where conduits pass through suspended floor slabs, sleeves shall be standard weight galvanized steel pipe extending 2" above the finished floor level.
- J. Sleeves at other locations shall be either light weight galvanized steel pipe or galvanized sheet steel. Clearance between conduits and sleeves shall not be less than 1/2".
- K. Sleeves through outside walls and below grade shall be caulked tight with oakum and the ends sealed with an approved semi-plastic coal tar base compound or shall be of the stuffing box type. Other sleeves shall be packed with glass wool ends sealed with Duxseal and covered with chrome plated escutcheon plates.
- L. Conduits entering through floor slabs at grade level will not require sleeves and shall be placed with tops of couplings flush at floor level.
- M. Sleeves for electrical conduit passing outside walls below grade shall be the through-wall and floor seal type.

3.2 INSTALLATION OF CONDUITS AND RACEWAYS:

- A. Raceways for electrical or signal systems run in earth that are not protected by permanent paving shall be encased in concrete with the encasement extending under the building. Branch circuit and signal system conduits installed underground between outlets, terminals, and panels within the building shall be liquid and gas tight.
- B. Conduits shall be concealed unless otherwise shown. All conduit runs exposed to view, except those in attic spaces, shall be installed parallel or at right angles to structural members, walls, or lines of the building.
- C. All conduit runs shall be mechanically and electrically continuous from outlet to outlet. Conduit size or type shall not be changed between outlets.
- D. No conduits shall be run on the roof unless specifically shown on the roof. They shall be full

weight rigid steel on PVC sleepers. Install roof jacks at penetrations.

- E. Conduit stubs installed for future extensions shall be rigid steel for at least 5' of a conduit run. The conduit ends shall be terminated with couplings and pipe plugs. The closed end shall be double wrapped with Scotchrap #50 for the last 12". The concrete envelope shall leave 3" of the wrapped conduit exposed for future connection.
- F. Conduit for equipment connected permanently to the floor shall be installed with a 6" rigid conduit nipple to a flush coupling to ensure a watertight connection at the floor.
- G. All conduits shall be sloping to drain and shall be sealed with JM Clipper "Duxseal" on the high end.
- H. All conduit bends shall be carefully made so that the conduit is not flattened, kinked or otherwise compromised. The inner radius of any conduit bend shall be not less than eight times the inside diameter. Where conduits are run exposed in groups, bends of all conduits shall have a common center. Use of standard elbows will not be allowed at these locations.
- I. Each run of a conduit shall be finished before concrete, plaster, etc., is installed to ensure against obstruction or omissions. After installation, the ends of all conduits shall be plugged with metal pennies. All conduit systems shall be completed and thoroughly cleaned and dried inside before installation of any conductors.
- J. Conduits shall enter at right angles and be connected to all outlet boxes, pull boxes, and cabinets with locknuts and plastic throated grounding bushings, providing a continuous grounding system in accordance with CEC Article 250.
- K. Use Erikson couplings where a union is necessary. Running threads will not be permitted.
- L. Pull 1/8" stranded nylon pull ropes with 18" coiled at each end in all empty conduits with identification tags indicating source and destination.
- M. Furnish and install seal-offs in all conduit runs through areas of different temperature.
- N. All concealed conduits shall be installed in as direct a line as possible between outlets. No more than four (4) quarter bends or their equivalent will be allowed between outlets. Feeder conduits shall follow arrangement shown on Plans unless a change is authorized. In general, branch circuit conduits shall follow the arrangement as shown insofar as structural conditions permit.
- O. All exposed runs shall parallel buildings, walls, or partitions, and shall be supported on Kindorf Hangers to meet Title 24 Part 6, California Code of Regulations.
- P. All telephone, data, and other signal conduits shall be installed with long radius sweeps. No factory ells will be permitted.
- Q. Chrome escutcheon plates are to be used on all conduit penetrating walls, floors or ceilings.
- R. Expansion joints shall be provided at building structural expansions or as required due to length of run or difference in temperatures.
- S. All fittings exposed or in damp areas shall have sealing glands and proper gaskets. Fittings in hazardous areas shall be of the type approved for the particular hazard.
- T. Provide two 1" conduit stubs out of all panels and terminal cabinets to above a hung ceiling

or as otherwise shown.

U. Roof Penetrations:

1. Where raceways penetrate roofing or any similar structural area, provide iron roof jacks sized to fit tightly to a raceway for a weather-tight seal with the flange extending a minimum of 9" under roofing on all sides. Completely seal the opening between the inside diameters of the roof flashing and the outside diameters of the penetrating raceways. Coordinate all work with the roofing section of Specifications.

V. Fire Penetration Seals:

1. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration before, during or after a fire. The fire rating of the penetration seal shall be at least that of which it is installed so that the original fire rating is maintained as required by CEC Article 300.21.
2. Where applicable, provide OZ Type CFSF/1 and CAFSF/1 fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs and similar structures. Apply an approved firestopping system, including wall wrap, partitions, caps and other accessories as required. All manufacturers' instructions and recommendations for installation of sealing fittings and barrier sealing systems.

3.3 CONDUCTORS AND CONNECTIONS:

A. General Requirements:

1. All branch circuit and fixture wiring joints, splices and taps for conductors #10 and smaller shall be made with UL approved connectors listed for 600 Volts. Connector bodies shall consist of a cone shape rotating expandable coil spring inserts insulated with phenolic or plastic shell.
2. Do not install wire in conduits until all work of any nature that may cause injury (including pouring of concrete) is completed. Use care in pulling in wires to prevent damage to wire or insulation. Do not use blocks, tackle or other mechanical means to pull #8 AWG or smaller conductors.
3. Splices are not permitted except in outlet boxes, pull boxes, junction boxes, panelboard gutters and auxiliary gutters. No splices shall be made in underground boxes.
4. Use only wire pulling compounds listed by the UL as a lubricant for pulling conductors through raceways. The use of cleaning agents that have deleterious effect on conductor coverings are not permitted.
5. Unless otherwise shown on Plans or specified elsewhere, leave at least 12" of free conductors at each connected outlet (outlets connected to equipment or device) and 9" of free conductors and coil neatly in outlet box for future connection.

B. Terminations:

1. Circuit and signal terminations to single screw or push on terminals shall be done with insulated "Sta-Kons" or approved equal terminals.
2. Bolt type solderless connectors shall be torqued with a torque wrench according to the manufacturer's recommendations and then retightened after 24-48 hours before taping. Owners' inspector shall be informed of this procedure during the waiting period and shall witness the act of retightening.

C. Feeders and Branch Circuits:

1. Connectors and lugs for terminating stranded conductors sized #8 and larger shall be machine crimp compression type.
2. All splices shall be taped with Scotch "Super 88" vinyl electrical tape, and "Scotch Fill" tape putty where necessary for a smooth joint. For other than normal temperatures or conditions, Scotch #27 or #2520 shall be used.

3. No splices shall be made below grade in a manhole or pull holes without the Engineer's written approval. When approved, these shall be encapsulated with 3M potting kits per 3M Specifications.
4. Wires in panels, cabinets, pullboxes and wiring gutters shall be squared, labeled, and neatly grouped with Ty-raps and fanned out to the terminals.
5. Support all conductors in hand holes/manholes and label with plastic rope. Tag all conductors with plastic waterproof tags.

3.4 WIRING DEVICES:

- A. Wiring devices shall be securely fastened to the outlet box. Where the outlet box covers are back from the finished walls, the device shall be built-out with washers so that it is rigidly held in place to the box. Provide metal extenders in flammable construction per CEC.
- B. All device screw slots shall be left in a vertical orientation.

3.5 OUTLET BOXES:

- A. Boxes shall be securely fastened in position to the ceiling or walls with screws or bolts. Nails are not acceptable. The Contractor shall set and align all equipment, level, bolt down, or otherwise secure in place. No back-to-back or through-boxes shall be used.
- B. Boxes shall be accurately located and set square and true with exposed edges of a box or plaster ring flush with finished surface of walls or ceiling. All unused boxes shall be equipped with blank covers that shall match existing covers.
- C. Boxes shall have no unused openings.
- D. Boxes shall be cleaned of all direct plaster, etc., before conductors are installed. Rust spots shall be scraped to bare metal and painted with Rust-Oleum "Cold Galvanizing Compound".
- E. Suspended fixture outlets shall be equipped with 3/8" fixture mounting stud bolted to wood backing or metal studs to safely support fixture weight.
- F. Make any change in outlet location necessary to all job conditions and rearrange fixtures and equipment as directed.
- G. Study all Plans as to relation of spaces surrounding outlets so that this work may be installed at the proper time with others. Fixtures and equipment shall be symmetrically located. Conflicts and discrepancies shall be referred to the Architect immediately and prior to box installation.

3.6 JUNCTION AND PULL BOXES AND WIREWAYS:

- A. Boxes shall be installed square and plumb. An engraved nameplate shall be installed indicating the function of each box on the exterior in unfinished areas and on the interior in finished areas. Permanent markers are not acceptable.
- B. Pullboxes and wireways shall be concealed or installed flush in finished areas. They shall be surface mounted in machine rooms or unfinished areas.

3.7 TERMINAL CABINETS AND CLOSETS:

- A. Install, level and identify per schedule.

3.8 FLOOR BOXES AND PEDESTALS:

- A. Floor boxes are to be installed level and plumb. Fill with paper prior to pouring concrete. Re-level after concrete has set, then raise to accommodate the floor finish.
- B. The installation of pedestals shall be coordinated with cabinet work.

3.9 PANELBOARDS:

- A. Location:
 - 1. Unless otherwise indicated on the Drawings, install all panels with the top of the trip 6'- 0" above the finished floor.
 - 2. Space permitting, surface mount the panels where they are not visible to the public.
 - 3. Panels to have a protective cover over any electrical panel with overhead water piping. Cover to be 18" by width of a panel.
- B. Directory:
 - 1. Mount a typewritten directory behind glass or plastic in a metal holder welded to the inside of each panel door. Directory shall indicate circuit numbers and complete description of all loads on each circuit.

3.10 DISCONNECT DEVICES:

- A. Disconnect devices shall be identify the location of the controlled device.

3.11 GROUNDING:

- A. The conduit system supports, cabinets, switchboards, etc., and neutral conductors must be permanently and effectively grounded by means of approved ground clamp, in accordance with the electrical safety orders of the Department of Industrial Relations of the State of California.
- B. This Contractor shall exercise every precaution to obtain good contacts at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduit shall be bonded around the boxes with a #6B&S gauge, rubber covered, double braided wire with ground clamps.
- C. Equipment and raceway bonding procedures shall be rigidly maintained and meet all jurisdictional requirements of codes and regulations.
- D. A separate grounding conductor shall be run in all receptacle circuits.

3.12 IDENTIFICATION

- A. Conductors:
 - 1. All power and low voltage systems conductors and cabling shall be identified in accordance with the following schedule:
 - a.) 120/208 Volts, 3-phase, 4-wire Wye: Red-Black-Blue, Neutral White
 - b.) 120/240 Volts, 3-phase, 4-wire Delta: Black-Blue for single-phase, Orange for 3-phase stinger, Neutral White
 - c.) 480/277 Volts, 3-phase, 4-wire Wye: Yellow-Brown-Purple-, Neutral Grey
 - d.) Bond or grounding conductor (GWG): Green
 - e.) Special system conductors shall be color coded and labeled
 - 2. Brady Labels shall be used to identify terminals and destination of feeders, branch circuits, signal and control circuits, etc., at all terminations and junction boxes and

- shall be coordinated with the nameplates in all boxes and equipment.
3. All terminals in the switchboards, panels, relays, switches, devices, starter terminals, etc., shall have Brady Labels for identification to identify both ends of all wiring. Wires #8 and smaller to be terminated on terminal strips squared-type 9080K with white marking strip and screw lugs for wire size.
- B. Nameplates: The Contractor shall furnish and install 1" x 3" x 3/32" thick laminated black Nylon nameplates with a white core, unless specifically shown as red with a white core, engraved to produce white letters on black background for all items of electrical equipment including 2-pole and 3-pole circuit breakers, panelboards, starters, relays, time switches and disconnect switches. The plates shall be screwed in place with stainless steel screws. Adhesive backed plates are not acceptable.
- C. Panels: Panels having single-pole circuit breakers shall be provided with typed schedules mounted in welded metal holders behind plastic.
- D. Devices: All devices shall have their branch circuit identified on the back side of device plate with a permanent type black marker, i.e., CKT A-21.

3.13 CONCRETE PADS, PULL HOLES AND MANHOLES:

- A. Contractor shall provide a minimum of 3'-6" of sand or base material suitable to receive the manhole. The base material shall be compacted, graded level, and at proper elevation to receive the manhole in relation to the conduit grade or ground cover requirements as designated in the Plans.

3.14 SUPPORTS AND ANCHORS:

- A. Provide inserts, anchors, supports, rods, brackets and miscellaneous items to adequately support and secure the electrical systems and equipment.
- B. Secure hangers, brackets, conduit straps, supports and electrical equipment to surfaces by means of toggle bolts on hollow masonry. Utilize expansion shields and machine screws or standard preset inserts on concrete or solid masonry. Utilize machine screws or bolts on metal surfaces. Utilize wood screws on wood construction. Wood, fiber plugs, or concrete nails are not acceptable.
- C. Power or velocity driven inserts may not be used for any anchorage unless specifically approved by the Engineer and where the use does not affect the finished appearance of work. Under no circumstance shall these be used in pre-stressed slabs, beams, purlins, or precast members in tension.
- D. Seismic Requirements: Provide vertical and lateral supporting equipment to resist the application of seismic forces per California Code of Regulations, Title 24 Chapter 23.

END OF SECTION 26 05 00

SECTION 26 20 00 LOW VOTLAGE ELECTRICAL TRANSMISSION

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

- A. A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 - Specification sections, apply to work of this section.
- B. B. Section 26 05 00 - Basic Materials and Methods section and other Division 26 sections apply to work specified in this section.

1.2 SCOPE:

- A. Work included: Furnishing and installation of a complete electrical service, distribution, and grounding system. Conditions of this section apply to all other 26 40 00 series sections included.
- B. Related Work: Refer to other sections, particularly those listed below, so as to properly coordinate work specified herein with that specified elsewhere to produce a finished, workmanlike, fully functioning installation.
- C. All other Electrical Sections: Division 26

1.3 QUALITY ASSURANCE:

- A. See Section 26 05 00.

1.4 SUBMITTAL:

- A. A. Product Data: Submit manufacturer's data on service entrance equipment, switchboards, motor control centers and/or individual starters, transformers, panelboards, disconnect switches and grounding components.
- B. Trip Curves: When requested, submit trip timing curves for all circuit interrupting devices.
- C. C. Nameplate Schedule: Submit nameplate schedule for approval.

1.5 COMPONENT COORDINATION:

- A. In order to maintain close control and coordinate the various components of the distribution systems, the number of manufacturers shall be kept to a minimum. Equipment manufacturer shall be General Electric or Square D. It shall be the manufacturer's responsibility though the Electrical Contractor to coordinate all components of the system in order to ensure systems that will provide maximum protection of equipment and reliable safe operation.

1.6 NAMEPLATES:

- A. Laminated phenolic plastic, color coded black for 120/208 volt equipment, with white letters. Provide for identification of each transformer, panelboard and motor control center, secure to face with two (2) chrome plated screws each. A schedule of nameplates shall be included with the shop drawings for approval.

1.7 FEEDER CONNECTIONS:

- A. Provide cast, saddle type bolted lugs or hydraulically set compression lugs for all bus connections. Manufacturer shall be Thomas and Betts, Burndy, O.Z. or approved equal. Lugs in which the set of screw embeds directly into feeder conductor shall not be used.

1.8 MISCELLANEOUS:

- A. Equipment Bases: Provide appropriately sized concrete housekeeping bases for all floor-mounted equipment.
- B. Hoisting Lifting Lugs: Provide on all heavy equipment as required to ensure safe hoisting.
- C. Space for Future Protective Device: Provide as indicated on drawings; shall be completely equipped for the future addition of a circuit breaker or fused switch, including all connections.

PART 2 PRODUCTS

2.1 PANELBOARDS:

- A. A. Panelboards shall be Bolt-down Circuit Breaker type, with voltage, phase, and breakers as specified in panelboard schedules. Panelboards shall be installed flush or surface or specified, at locations as indicated on plans. Panelboards shall be installed in code gauge rust proof steel cabinets with flush door having flush locks all keyed alike and with trim cut square and true.
 - 1. Panelboards: Square D, type NQ, NQOB, and NF; General Electric A-Series and Spectra Series; or approved equal.
- B. All panelboards and breakers shall meet the requirements of the indicated available symmetrical short circuit current or have a minimum bus bracing to meet figure shown.
- C. All interiors shall be completely factory assembled. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors, so that circuits may be changed without machining, drilling or tapping.
- D. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. A nameplate shall be provided listing panel type and ratings.
- E. Unless otherwise noted, full size insulated neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug or each outgoing feeder requiring a neutral connection. A ground bus will be included in all panels.
- F. Boxes shall be at least 20 inches wide made from galvanized steel. Provided minimum gutter space in accordance with California Electric Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
- G. Door hinges shall be concealed. All locks shall be flush, stainless steel, cylinder tumbler type locks with catches and spring loaded door pulls, keyed alike and directory frame and card having a transparent cover shall be furnished with each door.
- H. All exterior and interior steel surfaces of the trim shall be properly cleaned, primed with a rust inhibiting phosphatized coating and finish with a gray ANSI 61 paint. Trims for flush panels shall overlap the box for at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim clamps shall not be accessible when the panel door is closed and locked.
- I. All main bus bars shall be cooper or tin plated aluminum sized in accordance with UL standards to limit the temperature rise on any current carrying part to a maximum of 50 degrees C above an ambient of 40 degrees C maximum.
- J. Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating, and have common trip on all multipole breakers. (Trip indication shall be clearly shown by the breaker handle taking position between ON and OFF when the breaker is tripped). Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall

be UL listed as "Switching Breakers" and carry the SWD marking. UL Class A (5 milliampere sensitivity) ground fault circuit protection shall be provided on 120V ac branch circuits as specified on the plans or panel board schedule. This protection shall be an integral part of the branch circuit breaker which also provided overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional slide pole circuit breaker. Connections to the bus shall be bolt on.

2.2 DISCONNECTS:

- A. Motor and circuit disconnects shall have an Underwriters' Laboratory label.
- B. Disconnect switches shall be suitable for area where they are installed, i.e., weatherproof, and shall be rated heavy duty. Use only 600 volt class with proper number of poles. Switches shall be fused unless indicated on plans. Fuses shall be of type specified on plans.
- C. When a disconnect switch is not clearly visible from the control location, provide an operating handle which is lockable in the open position.

2.3 GROUNDING:

- A. Clamps, bonds, etc. suitable and as necessary to provide continuous ground system.
- B. Ground Rods: "Copperweld" 3/4" diameter 8' long.
- C. All grounding conductors shall be copper, sizes not less than that required under CEC Table 250.122.
- D. All grounding electrode conductors shall be copper, sizes not less than that required under CEC Table 260.66.

2.4 SWITCHBOARDS:

- A. Manufacturer's: Subject to compliance with requirements, provide switchboards of one of the following:
 - 1. General Electric Company
 - 2. Square D Company
- B. General: Except as otherwise indicated, provide switchboards of types, sizes, characteristics, and ratings indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for complete installation. Service entrance switchboards shall comply with serving utility requirements.
- C. AC Dead-Front Distribution Switchboards: Provide factory assembled, dead-front, metal enclosed, self-supporting secondary power switchboards, of types, sizes and electrical ratings and characteristics indicated; consisting of panel (vertical) units, and containing circuit breakers of quantities, ratings and types indicated. Provide copper or tin plated aluminum main bus and connections to switching devices of sufficient capacity to limit rated continuous operating temperature rise to 54 degrees F, and 90 degrees F for circuit breaker branches; with main bus and tap connections silver-surfaced and tightly bolted for maximum conductivity. Brace bus for short circuit stresses up to maximum interrupting capacity. Prime and paint switchboard with manufacturer's finish and color. Construct units for outdoor, NEMA Type 3R.
- D. Enclosures: Construct dead-front switchboards, suitable for floor mounting, with front cable/wire and conduit accessibility as indicated. Provide welded steel channel framework, hinge wireway front covers to permit ready access to branch circuit breaker load slide terminals. Coat enclosures with manufacturer's standard corrosive resistant finish.

- E. Bussing: Provide switchboard with sufficient cross-sectional area to fulfill U.L. Standard 891 pertaining to temperature rise.

2.5 MOTOR STARTERS:

- A. A. Manual motor starters to be quick-make, quick break, with overload protection. General Electric cr 101 for 120/240 volt 1 hp or less.
- B. B. Magnetic motor starters shall be across the line unless indicated with control power transformer (120 volt coil) and with overload relay protection. Combination type shall have integral fused switch or circuit breaker as indicated.

2.6 TRANSFORMERS:

- A. Transformers, Dry Type: Distribution transformers shall be constructed and tested in accordance with ASA and NEMA Standards, TP-1 minimum, and shall be wound with copper conductors. Performance of transformers shall be equal to or exceed ASA and NEMA published criteria.
- B. Transformers shall be self cooled type with Class H, NEMA, Group 111 insulation and a temperature rise of 150°C under continuous full load conditions with an ambient of 400°C.
- C. Transformers supplying voltage to wave altering devices (computers, electronic ballasts, etc.) shall be K3 rated minimum, or as noted otherwise on plans.
- D. Transformers shall be equipped with four 2 1/2% taps (2 taps above and 2 taps below normal voltage). Windings shall be of the fire resistant type, designed for natural convection cooling through normal air circulation.
- E. Core mounting frames and enclosures shall be of welded and bolted construction with sufficient mechanical strength and rigidity to withstand shipping, erection and short circuit stresses.
- F. Enclosure cover plates shall be Code gauge sheet steel, captive bolted to the enclosure framework. Enclosure shall have suitable ventilating openings with rodent proof screens. Enclosure shall be provided with lifting lugs and jacking plates as required.
- G. Transformers shall be furnished complete with mounting channels and mounting bolts. Metal parts, except cores and core mounting frames, shall be cleaned, rust proofed and given a heavy coating of an inert primer.
- H. Transformers used indoors shall be "low noise." They shall be provided with vibration dampers. Size and number of shock mounts shall be in accordance with manufacturer's recommendations.
- I. Transformers shall be manufactured by General Electric, Square D, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION OF SWITCHGEAR AND SWITCHBOARDS:

- A. Install switchgear and switchboards as indicated, in accordance with manufacturer's written instruction, and with recognized industry practices to ensure that switchboards comply with requirements of NEMA and CEC standards, and applicable portions of NECA's "Standard of Installation".
- B. Prior to energization of circuitry, check all accessible connections to manufacturer's torque specifications. Subsequent to wire and cable hook-ups, energize switchboards and demonstrate functioning in accordance with requirements.

3.2 INSTALLATION OF PANELBOARDS:

- A. Provide mounting brackets, busbar drilling, and filler pieces for unused spaces.
- B. Branch circuits shall be connected as shown in line diagrams and/or panelboard schedules, with wires neatly tie wrapped in panel.

- C. All distribution panelboards shall have all sub feeders and main breakers marked with 1" x 3" plastic name tags secured with two self tapping screws.
- D. All panelboards shall be provided with a 2" x 3-1/2" plastic name tag on the front of the panel door or on the trim, indicating panel designation and distribution panel and circuit feeding above panel, secured with two self tapping screws.
- E. Branch circuit panelboards shall have a plastic covered circuit directory card on the inside of each door with all circuit destinations neatly typed.
- F. Contractor shall check and tighten all factory made wire or lug connections. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.
- G. Install four (4) spare 3/4" conduits from all panelboards to accessible ceiling space.

3.3 INSTALLATION OF DISCONNECTS:

- A. Install disconnects for all equipment and motors of the size required and as recommended by manufacturer.

3.4 INSTALLATION OF GROUNDING:

- A. Scope: Provide grounding system complying with the codes and ordinances specified. Grounding system shall provide continuity through the entire electrical system.
 - 1. Panelboard ground buses.
 - 2. PVC conduit or other raceways.
 - 3. All motors.
 - 4. All lighting fixtures.
 - 5. Grounding terminals of all receptacles.
 - 6. Miscellaneous grounds required by code.
- B. Equipment and raceway bonding procedures shall be rigidly maintained and meet all jurisdictional requirements of codes and regulations.
- C. Good, electrically continuous, metal to metal contacts shall be made wherever possible at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduit shall be bonded round the boxes with a 6 BS gauge, rubber covered, double braided wire with ground clamps.
- D. A separate grounding conductor shall be run in all conduit runs from distribution, lighting, and power, etc. panelboards, motor control outlets, etc., back to their respective service or distribution panelboards.
- E. Flexible Conduit Grounding: Provide a separate grounding conductor in all flexible conduit runs to include watertight flexible conduit with integral grounding straps. Install ground conductors inside conduit with ungrounded conductors. Extend from nearest panel to device being connected.
- F. Receptacle Circuits: Provide a separate grounding conductor in all receptacle circuit conduit runs, back to serving panelboard.

3.5 INSTALLATION OF MOTOR STARTERS:

- A. In finished areas, mount motor protection switches flush and install suitable cover plates.
- B. Install heaters correlated with full load current of motors provided.
- C. Set overload devices to suit motor provided.

3.6 INSTALLATION OF TRANSFORMERS

- A. Transformer core frame shall be installed level on shock absorbing pads within the

enclosure.

- B. Mounting bolts on floor-mounted transformers shall be extended into pads only and shall not be in direct contact with building structural members.
- C. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits.
- D. Voltage Check:
 - 1. The Contractor shall set the taps on all transformers (which are a part of this contract) as necessary to provide satisfactory operating voltages with all present loads energized. A check shall be made in the presence of the District Inspector at a panel fed from each transformer and which is the farthest from the transformer. Voltages at the transformers ranging from 118 to 122 volts inclusive, for 120-volt systems and proportionately equivalent for higher voltage systems, are acceptable.
 - 2. The Contractor shall provide all instruments and accessories required to perform the checks. Volt meters shall be accurate within 1% and shall have scales permitting the voltage readings to be made on the upper half of the scale.

3.7 CONNECTIONS TO NEW MANHOLES

- A. Construct concrete-encased duct lines connecting to underground structures to have a flared section adjacent to the manhole to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the encasement and the wall of the structure.

3.8 CONNECTIONS TO EXISTING MANHOLES

- A. For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and bend out to tie into the reinforcing of the duct line encasement. Chip out the structure wall to form a key for the duct line encasement.

END OF SECTION 26 20 00

SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish and install lighting fixtures including lamps; connect fixtures to circuits, occupancy sensors, relays, room controllers, contactors, control panels, and gateways, where applicable.
- B. Related Work:
 - 1. Common Work Results for Electrical: Section 26 05 00.
 - 2. Low Voltage Electrical Transmission: Section 26 20 00.

1.2 SUBMITTALS

- A. All submittals shall be made in accordance with Division 1 Submittal Procedures.
- B. List of Materials: Submit a complete list of material proposed for this Section.
- C. Shop Drawings for Lighting Fixtures: Provide detailed and dimensioned working drawings showing kind, weight and thickness of materials, method of fitting and fastening parts together, location and number of sockets, size and color of lamps, and complete details of the method of fitting, suspension and securing the fixtures in place. Drawings shall contain sufficient information to enable a workman to construct and install the fixtures without further instructions.
- D. Shop Drawings for Lighting Controls: Provide detailed and complete wiring diagrams and plans for lighting controls. Provide cut sheets for lighting control devices and cabling.

1.3 MOUNTING REQUIREMENTS

- A. Comply with State of California earthquake requirements and CEC requirements for lighting fixture installations and support.

1.4 GUARANTEE

- A. Guarantee lighting components against service failure for five years. Indicate installation date on each driver by inscribing month, day and year on the housing.

PART 2 PART 2 – PRODUCTS

2.1 MATERIAL AND FABRICATION

- A. Each lighting fixture shall be the type indicated on the drawings and as specified herein. Fixtures of the same type shall be of identical make, design and appearance. The size of each lighting fixture shall be as specified herein for the lamp or fixture wattage indicated on the drawings.
- B. The design of all lighting fixtures, accessories and supports, as well as the method of hanging fixtures, shall comply with all requirements for earthquake resistant construction of the State of California.

2.2 LIGHT FIXTURES

- A. LED Drivers: Drivers shall be electronic type specifically designed to save energy while

maintaining full light output. Drivers shall have "A" sound rating, thermal protectors and guaranteed against service failure for three years. Drivers shall comply with FCC and NEMA limits governing electromagnetic and Radio Frequency Interference and meet all applicable ANSI, State and Federal standards. The contractor shall indicate the installation date on each driver by inscribing the month, day and year on the ballast case. Drivers shall be noiseless, high power factor type and shall be ETL certified under CBM Standards and Underwriters' Laboratory listed.

- B. LED Diodes shall have the following minimum characteristics:
 - 1. Efficacy – 100 lumens per watt or greater
 - 2. Color rendition index – 80 or greater
 - 3. Standard deviation color matching for diodes shall fall within 1 MacAdam ellipse.

2.3 LIGHTING CONTROLS

- A. Lighting controls and control systems shall meet all requirements of the State of California Title 24 energy code.
- B. Lighting control systems shall be commissioned by a factory lighting commissioner. Commissioning by the contractor is not acceptable.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install lighting fixtures where shown on plans.
- B. Fixture voltage shall be as shown on drawings and in the fixture schedule.
- C. Install recessed and surface-mounted fixtures with mounts or plaster frames compatible with the ceiling and wall systems employed and secure fixtures mechanically to frames.
- D. Align rows of surface-mounted fluorescent fixtures to form straight lines at uniform elevations. Provide factory joiner bands for contiguous fixtures, and end caps on ends.
- E. Recessed fixtures shall fit snugly against ceilings to prevent light leakage.
- F. Support suspended recessed fixtures in a T-bar ceiling as follows: All fixtures shall be attached to the ceiling grid to resist a horizontal force equal to the weight of the fixtures. For heavy duty grid systems, fixtures weighing less than 56 pounds must also have two 12 gauge slack safety wires from diagonal corners to the structure above; fixtures weighing more than 56 pounds shall be independently supported by not less than 4 taut No. 12 gauge wires capable of supporting four times the load. For intermediate duty grid systems, fixtures shall be independently supported by not less than four taut No. 12 gauge wires capable of supporting four times the load. All fixture hanger wire ends shall be twisted three tight turns within a 2" distance. Fixture installation shall be coordinated with the acoustical ceiling installation.
- G. Light Pole Installation:
 - 1. Set in concrete footings; set poles plumb and straight. Grout and drypack after leveling poles. Concrete, grout and drypack are specified under Section 03 30 00, Cast-in-Place Concrete.
 - 2. Electrically ground the fixtures and poles.
 - 3. Solder and tape splices as required for the floodlight fixture installations.
 - 4. Each standard shall be tapered galvanized steel, with handhole, anchor bolts, fixture mounting brackets and all accessories.
 - 5. Poles shall be designed to withstand a minimum wind velocity of 80 mph sustained, 104 mph gusts.
- H. Provide factory commissioning for lighting controls and devices. The completed installation shall comply in every way with the requirements of Title 24.

3.2 CLEANING

- A. Clean surfaces of all dirt, cement, plaster and other debris. Use cleansers compatible with material surfaces being cleaned.
- B. Clean lenses, reflectors, and the like of dust, fingerprints, and grime.

3.3 TESTING

- A. Check and adjust fixtures for even illumination.
- B. Replace defective fixtures and fixture components with new.
- C. The lighting control system shall be acceptance tested by an independent company. The agent shall not be an employee of or affiliated with the contractor. The contractor is responsible for passing the acceptance tests.

PART 4 END OF SECTION

**SECTION 27 00 00
COMMUNICATIONS**

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. This specification section provides general conditions for all division 27 specifications. All contractors working with in the division 27 specification shall adhere to this specification.

1.2 STATEMENT OF WORK

- A. This document describes the requirements for the contractors, products and installation relating to furnishing and installing Structured Cabling and Communications Systems.
- B. Contractor will provide a bid including all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in this Document. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the contractor feels that the system described is incomplete they must address this in writing to the Owner/Owner's Representative before providing a bid.
- C. All questions concerning non-specified product and services will be address to the Owner's Representative before Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.
- D. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of devices, typical installation details, and mounting details will be provided as an attachment to this document. The successful vendor shall meet or exceed all requirements for the systems described in this document.
- E. 271000 contractor shall be complete with work including all testing and labeling prior to 272000 contractor work start. Also the district requires minimum of 10 days to review test documents prior to network start up.
- F. 272000 contractor will require that 271000 is complete prior to work start. 272000 will need minimum of five day burn in of network equipment prior to turnover to district.
- G. Contractors who remove district equipment shall label each piece for replacement by either the removing contractor, other contractor or district. Equipment tags shall have school name, room name and cabinet name/#.

1.3 EXISTING CABLING AND SYSTEMS EQUIPMENT

- A. Demolition of cabling systems per CEC 2013
 - 1. Remove all cabling defined for demolition per CEC 640.2, 640.6.C, 645.2, 645.5.F, 725.2, 725.25, 770.2, 770.25, 770.154.A, 800.2, 800.25, 800.154.A, 820.2, 820.25, 820.154, 830.2, 830.25,
 - 2. The owner shall be given "first right of refusal" for all decommissioned equipment and removed cable.
 - 3. The owner may wish to keep, recycle or destroy these items. If the items are refused by the owner the contractor may keep, recycle or destroy these items.
 - 4. Owner will establish a location for all materials it wishes to keep, recycle or destroy.
- B. Contractor SHALL NOT demo any existing analog telephone cables or outlets, except where complete reconstruction occurs. The existing telephone cabling will remain intact and used by the district upon re-occupancy. Contractor shall repair any telephone cabling they damage during this project. Cut cables must be replaced end to end, no splice repairs will be allowed.

- C. Contractor SHALL NOT demo any existing intercom cables or outlets, except where complete reconstruction occurs. The existing intercom cabling will remain intact and used by the district upon re-occupancy. Contractor shall repair any intercom cabling they damage during this project. Cut cables must be replaced end to end, no splice repairs will be allowed.
- D. Contractor SHALL NOT demo any existing coaxial CATV cables or outlets, except where complete reconstruction occurs. The cabling will remain intact and used by the district upon re-occupancy. Contractor shall repair any cabling they damage during this project. Cut cables must be replaced end to end, no splice repairs will be allowed.
- E. Contractor SHALL NOT demo any existing CCTV cables or outlets, except where complete reconstruction occurs. The existing cabling will remain intact and used by the district upon re-occupancy. Contractor shall repair any cabling they damage during this project. Cut cables must be replaced end to end, no splice repairs will be allowed.
- F. Contractor to coordinate with the Owner for the scheduled removal of any existing network equipment, such as, but not limited to, wireless access points, access point mounting brackets, network switches, and network routers. All equipment is to be labeled with the site name/room number it was removed from and returned to the district. The district has "first right of refusal" and any equipment deemed by the district as refused can be disposed of by the contractor.
- G. The district will update returned equipment and return it to the contractor for installation. Prior to the installation, the Owner requires a minimum of ten days to review & approve testing documentation. After the approval the contractor may proceed with the installation and cross connection of equipment. Labor hours to install Owner provided equipment shall be based on the single line drawings and cable port counts equal to 1:1; including network switches, wireless access points, and patch cables (copper and fiber). Contractor to connect each device as requested by owner with a patch cord provided by owner. Contractor to provide sign in/out sheets for all equipment removed and installed. Contractor may be liable for lost, misplaced, or stolen equipment. Contractor to provide a line item cost on the schedule of values for the removal stolen equipment. Contractor to provide a line item cost on the schedule of values for the removal and replacement of Owner provided equipment.

1.4 REGULATORY REFERENCES

- A. Contractor will comply will all Federal, State, Local Codes/Regulations and Industries Standards.
 - 1. Federal:
 - FCC - Part 15, Part 68
 - ADA – Americans with Disabilities Act
 - 2. State of California:
 - CCR Part 2 - California Building Code 2022
 - CCR Part 3 - California Electrical Code 2022
 - Occupational Safety and Health Act (OSHA).
 - Title 24, Building Standards, State of California.
 - Title 19, California Code of Regulations.
 - Title 8, Electrical Safety, State of California
 - 3. ANSI Standards
 - ANSI C2-2001 National Electrical Safety Code.
 - ANSI C80.3 Specification for Zinc-coated Electrical Metallic Tubing.
 - ANSI/UL 797 Electrical Metallic Tubing.
 - ANSI/ICEA S-83-596-2001 - Fiber Optic Premises Distribution Cable Technical Requirements.

4. Industry Standards:

Telecommunications Industry Associations/Electronics Industry Association
(TIA/EIA)

5. TIA/EIA-568-C Commercial Building Telecommunications Cabling Standard
6. TIA/EIA-568-C.1 General Requirements
7. TIA/EIA-568-C.2 Balanced Twisted Pair Cabling Components Standard
8. TIA/EIA-568-C.3 Optical Fiber Cabling Components Standard
9. TIA/EIA-569-A Commercial Building Standard for Telecom Pathways and Spaces
10. TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
11. TIA/EIA-607 Commercial Building Grounding/Bonding Requirements
12. TIA/EIA-758 Customer-Owned Outside Plant Telecommunications Cabling Standard
13. TIA/EIA-758-1 Addendum No. 1 to TIA/EIA-758, Customer-Owned Outside Plant Telecommunications Cabling Standard

National Electrical Manufacturer's Association (NEMA)
Institute of Electrical and Electronic Engineers (IEEE)

14. 802.3 (Ethernet)
15. 802.3ab (Gigabit Ethernet over 4-pair Category 5e, 6 & 6A or higher) 802.3Z (Gigabit Ethernet over optical fiber)

Underwriters Laboratories Inc. (UL)
International Organization for Standardization/International Electromagnetic Commission (ISO/IEC) ISO 11801 Generic Cabling for Customer Premises
Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM 12th Edition or latest).
ASCII - American Standard Code for information Interchange
ASTM - American Society for Testing and Materials

- B. If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- C. This document does not replace any code, either partially or wholly. The contractor must be aware of and comply with all local codes that may impact this project.

1.5 SAFETY/CONTRACTOR QUALIFICATIONS/QUALITY ASSURANCE

A. Safety and Indemnity

1. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of persons and property during performance of work.
2. The Contractor shall ensure that all personnel working in or anywhere on the site shall be provided a hard hat, safety shoes, a face shield or safety goggles, etc. for their protection.
3. No act, service, drawing review or construction observance by the owner's representative or any other party employed by the campus is intended to include review or approval of adequacy of the Contractor's safety measures, in, on or near the construction site.

B. Contractor Qualifications

1. Each low voltage contractor/sub-contractor shall submit their qualifications to the district prior to award of contracts.
2. Contractor shall have been in business for no less than five (5) years and have installed of a minimum of 3 projects of similar size and scope.
3. A Manufacturer Certified Installer contractor shall complete the System installation. The contractor shall have completed standards based product and installation training. A copy of the Contractor's Manufacturer Certified Installer certificate shall be submitted with their submittal.
4. Sub-Contractor Qualifications

All Contractors shall submit a list of at least three (3) projects of similar dollar volume completed within the past 24 months for reference purposes. The Contractor shall compile detailed information relating to similar work completed, including corporate references sufficient to enable the Owner to evaluate and agree to the Contractors' responsibility, experience and capacity to perform the work.

Each Contractor to perform telecommunications work on this project shall possess a C-10 or C-7 (formerly C-61) Limited Specialty License for Telecommunications and must be certified for the installation, termination, splicing, and testing of copper cables, fiber optic cable, riser cable, and inside wiring. The appropriate contractor's license for underground construction and conduit installation is also required.

An on-site Contractor superintendent must be available at all times. Contact can be by person or telephone.

5. Contractors who do not meet the minimum specified requirements will not be accepted.

C. Quality Assurance: Contractors are required to comply with the following without exception:

1. The winning Contractor will assign this project to a competent Project Manager who has demonstrated their ability to supervise a telecommunications project of the same size and scope.

The contractor will make this person available to the Owner/Owner's Representative before the start of this project for an interview. This person must be deemed acceptable by the Owner and/or their Representative before work can begin.

Project Manager will be required to be available for scheduled on site project meetings at no additional cost to the Owner.

Project Manager will be required to be available to meet on site with the Owner/Owner's representative with a minimum of 24 hours' notice for non-emergency issues, and a minimum of 4 hours for emergency issues at no additional cost to the Owner.

2. All material and equipment to be installed on this project shall be "new". If the Owner/Owner's Representative discovers that "used" material or equipment has been installed on this project the Contractor will be required to replace said materials and/or equipment with "new" products at no additional cost to the Owner.

"New" - Materials and products manufactured within one (1) year prior to installation, and meet or exceed the latest published specifications of the manufacture. Also these materials and equipment may not have been in use before installation on this project unless directed otherwise in the project documents.

3. Contractor must warranty all materials, equipment and labor for a minimum of one (1) year from the Owner's acceptance of the work.

Warranty will provide repair/replacement of all defective or improperly installed materials at no additional cost to the Owner (including Labor, drive time, shipping, taxes, etc.).

Contractor is required to keep in stock replacement parts for all items covered in this specification and provide a competent service technician to be on site to repair/replace defective items no later than 24 hours after receiving trouble call. Warranty will cover normal Business hours, 8am – 5pm, Monday thru Friday. All calls received on a Friday or the day before a holiday will be held until the following regular business day.

1.6 SUBMITTAL DOCUMENTATION

- A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule
- B. The successful contractor shall provide three (3) copies of their submittal package.
- C. The Submittal Package will include:

1. All documentation given will be in a Bond Cover or in a Three (3) Ring Binder.
2. A coversheet on the Contractor's Company Letterhead including:

Contractor's Name
Contractor's License Number
The Project Name
The Specification Number and Description
The date documentation was submitted.

3. A spreadsheet with a full material list of products and equipment included in the Contractor's bid price. Spreadsheet will provide:

Manufacture Name
Part Number
Description
Quantity to be installed for each part.

4. A legible copy of the Manufacturer's Catalog Cut sheet for each part included in the Contractor's bid.

The Catalog Cut sheets shall be placed in the same order as shown on the spreadsheet.

5. Copies of the Manufacturer's Certification for a minimum of the Project Forman and 50% of the installation crew.
 6. Sample of Labeling Scheme. Contractor will provide a sample for each identifier to be used on this project.
- D. LEED/CHIPS/HPSA (when applicable to project provide additional submittal information)
 1. Recycled content, segregated by pre- and post-consumer percentages.
 2. Rapidly renewable material content.
 3. VOC content
 4. Distances from site to follow material process locations.

Raw material harvest, collection or extraction
Product or component fabrication
Final material manufacture, if different than component fabrication

1.7 EQUIVALENT PRODUCTS

- A. Pre-Approved Equals:
 - 1. All pre-approved products shall be listed in the relevant specification section.
- B. Contractors wishing to approve a system other than those specified in this document will be required to perform the following:
 - 1. Provide System specifications and cut sheets for all system components for the proposed new system(s).
 - 2. Provide an itemized comparison to each of the system functions as described in this specification. Include in that document how the proposed system compares to the specified system described in this document on a line by line basis, using one of the following three criteria: "exceeds"/"matches"/"unequal".
- C. All other products than those specifically address in the bid document that the Contractor is seeking approvals for must be **received** by the Owner's Representative **no later than 5 business days before the bid date**. All Approved Equals will be published in addendum form prior to the bid date.
- D. Failure to received written approval for product installed that deviates from the products called for in this specification and/or on the project drawings will result in the contractor having to replace the unapproved materials and equipment with the originally specified products at no additional cost to the Owner.
- E. All proposed system documentation must be sent to the Owner's Representative via one of the following; mail, fax or email. The Contractor will include the project name, their contact information, and the specification section number that the proposed system is comparable to.

1.8 ACCEPTANCE AND WARRANTIES

- A. Project Acceptance
 - 1. The Owner and the Contractor shall accept the project as complete based on the following criteria:
 - Before executing any performance testing, the Contractor shall present a test plan to the Project Engineer for their approval.
 - The Contractor has completed all testing and delivered copies of all test results to the owner's representative.
 - All test results have been examined and approved by the Contractor and the Project Engineer.
 - Copies of all documentation required by this section have been delivered to the Project Engineer.
 - All punch list items are completed to the satisfaction of the Inspector-of- Record.
 - Manufacturer Warranty Certification Certificates are provided to the Owner.
 - 2. Following completion and/or compliance with the requirements listed above, the Contractor shall issue a Notice of Completion confirming that the project is complete. A 45-day acceptance period shall begin immediately following the issuance of the Notice of Completion.
 - 3. Minor failures shall be responded to at the Owner's discretion or within one business

day.

B. Manufacturer Warranties

1. The installed 271000 structured wiring (as applicable for given cable media) system, including both inter-building and intra-building sub-systems, shall be warranted by a manufacturer for a 15-year period or greater. Lifetime warranty is the warranty period preferred by the Owner.
2. The warranty certified systems will be a complete system comprised of products from a single solution manufacturer, warranted to operate as a guaranteed system for the entire channel (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.). The Solution Manufacturer shall administer a follow on program through the Vendor to provide support and service to the purchaser, and a single extended warranty point of contact. In the event that the certified system ceases to support the certified application(s), whether at the time of cutover, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.
3. The Contractor shall be responsible for correcting any problems and malfunctions that are warranty-related for the entire warranty period. In the event that a Contractor should not be in business at the time of an issue, the manufacturer shall be responsible for all corrections, if deemed the responsible party.
4. Copies of any extended material warranties shall be passed through to the Owner.
5. During the installation and up to the date of final acceptance, the Contractor shall protect all finished and unfinished work against damage and loss. In the event of such damage or loss, the Contractor shall replace or repair such work at no cost to the Owner or any other Trade Partnership working on the project.

END OF SECTION 27 00 00

SECTION 27 05 26
COMMUNICATIONS GROUNDING AND BONDING

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Communication system grounding.
 - 2. Communication equipment and raceway grounding and bonding.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. 1. Division 05: Building Steel.
 - 2. Division 26: Grounding and Bonding

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI) / Telecommunications Industry Association (TIA): ANSI/TIA-607-C-1; Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
 - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE): IEEE No. 142; Recommended Practice for Grounding of industrial and Commercial Power Systems.
 - 3. Underwriters Laboratories, Inc. (UL): UL 467; Grounding and Bonding Equipment.

1.3 SYSTEM DESCRIPTION

- A. A. Provide communications system grounding conductor and bus bars as described herein and indicated on the Drawings.
- B. Except as otherwise indicated, the complete communication installation including metallic conduits and raceways, cable trays, boxes, racks, cabinets, and equipment shall be completely and effectively grounded and bonded, whether or not such connections are specifically indicated or specified.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communications Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical

and electrical characteristics and ratings indicating compliance with all listed standards.

2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Bonding strap:
 - a. Chatsworth Product Inc. (CPI).
 - b. Cooper/B-Line Systems, Inc.
 - c. Thomas & Betts.
 2. Bonding connectors and lugs:
 - a. Chatsworth Product Inc. (CPI).
 - b. Cooper/B-Line Systems, Inc.
 - c. Panduit.
 - d. Thomas & Betts.
 - e. O-Z/Gedney.
 3. 3. Ground Bus Bar, Ground Straps, Ground Lugs:
 - a. Chatsworth Product Inc. (CPI).
 - b. Cooper/B-Line Systems, Inc.
 - c. Panduit.
- B. Substitutions: Under provisions of Section 270010: Basic Communications Requirements.

2.2 COMMUNICATION SYSTEM GROUND BUS REQUIREMENTS:

- A. Telecommunication Main Ground Bus (TMGB): Provide one 20" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in MDF room utilizing insulating stand-offs at 6" below bottom of cable ladder.
- B. Telecommunication Ground Bus (TGB): Provide one 12" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in each IDF room and in the MPOE room utilizing insulating stand-offs at 6" below cable ladder.
- C. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer, and Belleville washer. Torque all lug connections.
- D. All holes shall be drilled and tapped for single-hole lugs. Provide 3-spare lugs and lug spaces.

2.3 GROUND CONDUCTORS

- A. Refer to Specification Section 260519: Building Wire and Cable for conductor specifications.
- B. Conductor material:
 - 1. Provide annealed copper for all wire, conductor, and cable, unless otherwise indicated.
 - 2. Copper wire AWG #8 and larger shall be stranded, unless otherwise indicated.
 - 3. Copper wire AWG #10 and smaller may be solid or stranded as best suited for the installation.
- C. Insulation material:
 - 1. All insulated wire, conductor and cable shall be 600volt rated, unless otherwise noted on the Drawings.
 - 2. Thermoplastic-insulated building wire: NEMA WC 5.
 - 3. Copper wire, green insulation: Type dual rated THHN/THWN.
 - 4. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with CEC.
- D. Bonding pigtails: Insulated copper conductor identified green, sized per code, and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.4 EQUIPMENT BONDING

- A. General:

1. Provide a complete grounding and bonding system as shown on the drawings in Riser Diagram format. It includes grounding bus bars, grounding riser conductors, connections to main service ground system, ground lugs and clamps, etc.
 2. The work outlined in this Section covers the bonding of all telecommunication equipment and apparatus in the equipment rooms to the telecommunication system grounding backbone.
- B. Bonding conductor:
1. Conductor: #6 AWG (or larger), copper, stranded.
 2. Insulation: THHN/THWN, green in color.
- C. Cable runway bonding straps: Flexible braided copper strap with factory installed termination connectors.
- D. Connectors and lugs:
1. Conductor to conductor connector: C-type copper compression tap, heavy-wall, for tapping into unbroken continuous conductors as a splice, wire joint, "T" tap, or making parallel wire connections. Connector can be used with stranded or solid conductors.
 2. Conductor to busbar, racks, cabinets, conduit, cable shields, copper fuse protectors, building steel or other equipment/component connector: Two-hole, copper, compression type lugs for #6 AWG conductors.
 3. Conductor to cable runway connector: Cable tray ground clamp, Extruded aluminum/tin-plated, mechanical type connector with set screws for tightening both tray and bonding conductor.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of installed equipment to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 COMMUNICATION SYSTEM GROUNDING:

- A. In addition to grounding noted on the Drawings for the power systems, provide a telecommunication system ground riser for interconnecting the MDF, MPOE and all the IDF rooms in the building.
- B. Riser shall consist of the following:
1. Provide a telecommunication main ground bus (TMGB) wall mounted in the MDF room at the ground floor of building.
 2. Provide telecommunication ground bus (TGB) wall mounted in each IDF room and at MPOE room.
 3. From the TMGB provide one #1/0 THHN in 1-1/4" conduit to the main electrical room and terminate conductor at the power system main building ground bus.

4. 4. Additionally, from the TMGB provide one #1/0 THHN in 1-1/4" conduit to the MPOE room and terminate conductor at the TGB.
5. 5. If IDF rooms exist on the ground floor of building, provide one #1/0 THHN in 1-1/4" conduit from the TGB in each room to the TMGB in the MDF room. If there are no IDF rooms at ground floor, provide one #1/0 THHN in 1-1/4" conduit from the TGB in each IDF room at second floor and route to the TMGB in the MDF room at ground floor.
6. 6. From each of the TGBs at the IDF rooms on ground or second floor, route one #1/0 THHN in 1-1/4" conduit as a riser up the building to intertie all the TGBs in each IDF room that are stacked above.

3.3 INSTALLATION

A. Equipment bonding:

1. Provide telecommunication bonding conductor and appropriate hardware between the telecommunication system grounding backbone bus in each equipment room and the equipment racks/rack bays, overhead cable support, vertical cable support, telecommunication conduits, primary pathways that exit/enter the rooms (if applicable), and all other metallic telecommunication infrastructure components.
2. Telecommunication bonding conductor:
 - a. The minimum size for the bonding conductor shall be #6 THHN/THWN.
 - b. Install the bonding conductors in a manner that will protect them from physical and mechanical damage.
 - c. Route the bonding conductors in the shortest possible path, using right angles for turns and routed parallel to building lines.
 - d. Utilize a minimum of 1'-0" bending radius.
 - e. At the backbone ground busbar:
 - 1) Thoroughly clean the busbar prior to attaching connectors and terminating conductors.
 - 2) Attach connectors to the busbar with appropriate size cadmium bronze bolt, flat washer, and Belleville washer.
 - 3) Torque all connectors.
3. Rack bays:
 - a. Bond equipment racks, frames, frame bays, cabinets, server racks, and all other similar support systems located within the same equipment room or space to the backbone ground busbar in same room.

- b. Rack bays may be bonded in series using either of the following configurations:
 - 1) Provide a bonding conductor from the backbone busbar to the closest rack and route through ground lug connected to rack, extending the conductor the full length of the rack bay. Each individual rack shall have a ground lug attached that the bonding conductor passes through. Insulation on bonding conductor, where it passes through the lug, shall be removed prior to tightening connection around conductor.
 - 2) Provide a bonding conductor from the backbone busbar to the closest rack and then along the entire length of rack bay. "T" tap a pigtail, sized the same as the bonding conductor, from the bonding conductor to each individual rack and terminate on ground lug connected to rack.
- 4. Overhead and vertical cable runway support:
 - a. Bond cable runway located within the same equipment room or space to the backbone ground busbar in same room.
 - b. Provide a "ground kit" (straps and connectors) to bond sections of the runway for ground continuity. This requirement applies to runway sections and junctions within the same equipment room.

3.4 FIELD QUALITY CONTROL

- A. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- B. Prefunctional testing:
 - 1. Visual and mechanical inspection:
 - 2. Cable tests:
 - 3. Test values:
- C. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.
- D. Contractor shall replace at no costs to the Owner all cables, equipment and devices which are found defective or do not operate within factory specified tolerances.
- E. Contractor shall submit final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.5 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean all equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt and debris.
- B. B. Touch-up paint for any marks, blemishes or other finish damage suffered during installation

END OF SECTION 27 05 26

SECTION 27 05 28
COMMUNICATIONS PATHWAYS

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Conduit and fittings.
 - 2. Fire-rated wall and floor through-penetration.
 - 3. Boxes
 - 4. J-Hooks.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. 1. Division 01: Cutting and patching.
 - 2. 2. Division 03: Cast-in-place concrete. Protective envelope for underground conduit installations.
 - 3. Division 07: Sheet metal flashing and trim.
 - 4. Division 08: Access doors. Wall and ceiling access doors.
 - 5. Division 09: Painting. Exposed conduit and other devices.
 - 6. Division 31: Earthwork. Excavation and backfill for conduit and utilities on Project site.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. 1. American National Standards Institute (ANSI)/National Electrical Manufacturer Association (NEMA):
 - ANSI C80.3; Electrical Metallic Tubing, Zinc Coated.
 - ANSI/NEMA OS-1; Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
 - NEMA 250; Enclosures for Electrical Equipment (1000volts maximum).
 - 2. American Society for Testing and Materials (ASTM):
 - ASTM E84; Surface Burning Characteristics of Building Materials

- ASTM E119; Fire Tests of Building Construction and Materials
- ASTM E814; Fire Tests of Penetration Fire Stops
- ASTM E1725; Standard Test Methods for Fire Tests of Fire Resistive Barrier Systems for Electrical System Components
- 3. 3. Underwriters Laboratories, Inc. (UL):
 - UL 50; Enclosures for Electrical Equipment.
 - UL 263; Fire Tests of Building Construction and Materials
 - UL 514A; Metallic Outlet Boxes.
 - UL 514B; Conduit, Tubing and Cable Fittings.
 - UL 635; Insulating Bushings.
 - UL 651; Schedule 40 and 80 Rigid PVC Conduit.
 - UL 651A; Type EB and A Rigid PVC Conduit and HDPE Conduit.
 - UL 723; Surface Burning Characteristics of Building Materials
 - UL 797; Electrical Metallic Tubing - Steel.
 - UL 1479; Fire Tests of Through Penetration Firestops
 - UL 1773; Termination Boxes.
 - UL 2239; Hardware for the Support of Conduit, Tubing, and Cable
- 4. National Electrical Manufacturer Association (NEMA):
 - NEMA TC 2; Electrical Plastic Tubing and Conduit.
 - NEMA TC 3; PVC Fittings for use with Rigid PVC Conduit.
 - NEMA TC 6; PVC Plastic Utilities Duct (EB and DB Type)
 - NEMA TC 9; Fittings for PVC Plastic Utilities Duct (EB and DB Type)

1.3 SYSTEM DESCRIPTION

- A. Conduits supported from structure and within stud walls for the continuous routing of communication cables, where non-accessible concealed Work is indicated and where required by Code and/or shown on the Drawings. Conduits shall be sized for a 40-percent maximum cable fill ratio.
- B. Assemblies supported from structure for the continuous routing of communication cables, where exposed Work is indicated on the Drawings.
- C. J-Hooks supported from structure, above suspended ceiling, for the routing of

communication cables, where accessible through ceiling and where shown on the Drawings. J-hooks shall be sized for a 40-percent maximum cable fill ratio.

- D. Where exposed cable routing is indicated, provide conduit sleeves through walls, above suspended ceilings or at cable routing elevation, with insulated bushings on both ends, for access into enclosed spaces, i.e., offices, workrooms, conference rooms, etc. Sleeves shall be 2" minimum and 4" maximum conduits and shall be sized for a 40-percent maximum cable fill ratio.
- E. Provide UL listed fire-rated sleeves for passing through 1 and 2-hour rated walls and/or floors assemblies.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communications Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Furnish structural calculations for equipment anchorage as described in Section 270010: Basic Communications Requirements.
 - 4. Submit Manufacturer's installation instructions.
 - 5. Complete Bill of Material listing all components.
- B. Dimensions and configurations of equipment shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Conduit:
 - a. Metal conduit:
 - 1) Allied Tube and Conduit Co.

- 2) Triangle PWC, Inc.
- 3) Western Tube and Conduit Corp.
- b. Nonmetallic conduit:
 - 1) Prime Conduit.
 - 2) JM Eagle.
 - 3) Cantex.
- c. Fittings:
 - 1) Appleton Electric Co.
 - 2) OZ/Gedney.
 - 3) Thomas & Betts Corp.
 - 4) Carlon.
- 2. Fire-rated penetration assemblies:
 - a. EZ-Path, STI Firestop.
 - b. Hilti
 - c. 3M
 - d. Lowry's, Inc.
- 3. Boxes:
 - a. Outlet and junction boxes:
 - 1) Spring City Electrical Manufacturing Co.
 - 2) Thomas & Betts Corp.
 - 3) Raco, Inc.
 - b. Cast boxes:
 - 1) Appleton Electric Co.
 - 2) Crouse-Hinds.
 - c. Floor boxes:
 - 1) Hubbell Inc.
 - 2) Walker.
 - 3) Wiremold/Legrand.

- d. Pullboxes:
 - 1) Circle AW Products.
 - 2) Hoffman Engineering Co.
- 4. Precast concrete vaults:
 - a. Oldcastle Enclosure Solutions.
 - b. Jensen Precast.
- 5. J-Hooks Systems:
 - a. Erico nVent Caddy HP.
 - b. B-Line.
 - c. Panduit.
 - d. Mono-Systems, Inc.
- B. Substitutions: Under provisions of Section 270010: Basic Communications Requirements.

2.2 CONDUIT

- A. Electrical metallic tubing (EMT):
 - 1. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.
 - 2. Set screw type couplings: Hot dip galvanized, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2-inches. Setscrews shall be of case-hardened steel with hex-head and cup point to firmly seat in wall of conduit for positive grounding.
 - 3. Set screw type connectors: Hot dip galvanized, steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150-degree C temperature rated. Setscrew shall be same as for couplings.
 - 4. Raintight couplings: Hot dip galvanized, steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.
 - 5. Raintight connectors: Hot dip galvanized, steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.
- B. Rigid non-metallic conduit (PVC)
 - 1. Conduit:
 - a. Rigid polyvinyl chloride, Schedule 40 or 80 conforming to NEMA TC1 and UL 651, latest edition. UL listed for exposed and direct-burial applications and for 90-degrees C conductor insulation. Conduit shall include an integral bell fitting

at one end.

b. Rigid polyvinyl chloride, Type EB or DB conforming to NEMA TC 6 and UL 651, latest edition. UL listed for concrete encased burial and direct burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.

2. Fittings: Couplings, adaptors, transition fittings, etc., shall be molded PVC, slip on, solvent weld type conforming to NEMA TC3 for Schedule 40 or 80 and NEMA TC 9 for type EB or DB.

C. Miscellaneous conduit fittings and products:

1. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.
2. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.
3. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.
4. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate 0.75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless-steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.
5. Standard products not herein specified:
 - a. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
 - b. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
 - c. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.

2.3 FIRE-RATED WALL AND FLOOR THROUGH-PENETRATION

A. General:

1. Through-penetration firestop system shall have been tested for specific fire resistance rated construction conditions or acoustical and smoke related requirements conforming to construction assembly type, penetrating item type, annular space requirements, and rating involved for each separate instance.

2. Firestop rating shall match that of the wall or floor construction being penetrated.
3. Firestop systems shall be as outlined below:
 - a. Firestop putty.
 - b. Firestop putty pads.
 - c. Fire-rated cable pathways.
- B. Firestop putty:
 1. Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers, or silicone compounds.
 2. Putty shall be used to seal openings around conduit penetrations through rated walls or floors, to maintain the construction rating.
- C. Firestop putty pads:
 1. Intumescent, non-hardening, pliable putty pads designed to seal both through and membrane penetrations against the spread of fire and smoke around outlet boxes in rated construction.
 2. The pads are 6" x 8" x 0.125" thick.
 3. Pads are rated for up to 4-hour rated wall assemblies.
- D. Fire-rated cable pathway penetrations:
 1. Cable pathway penetrations shall be used in fire-rated construction for low-voltage cabling, where cables pass through fire-rated wall or floor construction.
 2. Cable pathways shall consist of an enclosed heavy-gauge galvanized steel housing lined with intumescent material engineered for rapid expansion when exposed to fire or high temperatures, quickly sealing the pathway, and preventing the passage of flames and smoke. The pathway shall be approximately 4" square x 14" long.
 3. Cable pathways shall meet the hourly fire-rating of fire rated wall and/or floor penetrated.
 4. Cable pathways shall be tested for the surrounding construction and cable types involved.
 5. Pathways shall be UL Systems permitting cable loads from 0 to 100-percent fill. This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
 6. Pathway shall be maintenance-free, having a corresponding Evaluation Services Report from a Nationally Recognized Third-Party Laboratory. Maintenance-free is defined as no action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
 - a. Opening or closing of doors.

- b. Spinning rings to open or close fabric liner.
 - c. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
 - d. Evaluation Services Report (ESR) from an accredited Nationally Recognized Third-party Laboratory certifying compliance with this definition of "Maintenance-Free" and all relevant codes and standards.
- 7. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
 - 8. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
 - 9. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

2.4 OUTLET BOXES

A. Standard outlet box:

- 1. Provide galvanized, one-piece die formed or drawn steel or welded, knockout type box of size and configuration best suited to the application indicated on the Drawings.
- 2. 4.687-inch square by 2.125-inch deep shall be minimum box size.
- 3. ANSI/NEMA OS 1.

B. Concrete box:

- 1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
- 2. Select height as necessary to position knockouts above concrete reinforcing steel.
- 3. ANSI/NEMA OS 1.

C. Pull and junction boxes:

- 1. Sheet metal pull and junction box:
 - a. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16-gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.
 - b. ANSI/NEMA OS 1.
- 2. Cast metal pull and junction box: Provide standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets.

3. Flush mounted pullboxes and junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

2.5 VAULTS

- A. Precast concrete: Concrete mix and reinforcing placement shall be in accordance with ACI 318. Design tops and wall structures for AASHTO H20 highway loading, with 30 percent loading added for impact. Walls shall withstand all soil pressures, taking into consideration the soil encountered and ground water level present at the Project site. Assume ground water level three feet below ground surface unless a higher water table is indicated in soils report.
- B. Construction:
 1. Monolithic or modular assembled sections.
 2. Assembled sections shall have mating edges with tongue and groove joints. Joints shall firmly interlock adjoining components and provide waterproof junctions. Seal joints watertight using preformed plastic strip.
 3. Provide lifting devices cast into units for proper handling of units.
 4. Identify all structures with Manufacturer's name embedded in or otherwise permanently attached to an interior wall face.
 5. Include concrete knockout panels for conduit entrance and sleeve for ground rod.
- C. Size and dimensions: As indicated on Drawings.
- D. Accessories:
 1. Frames and covers: Cast iron with cast-in legend "COMMUNICATIONS" or "LOW-VOLTAGE" as appropriate. Machine cover-to-frame bearing surfaces.
 2. Pulling eyes in walls: Eyebolt with reinforcing bar fastening insert. 2-inch diameter eye, 1-inch by 4-inch bolt. Working load embedded in 6-inch, 4000-PSI concrete: 13,000 pounds minimum tension.
 3. Pulling and lifting irons in floor: 7/8-inch diameter, hot-dipped galvanized, bent steel rod, stress relieved after forming and fastened to reinforced rod. Exposed triangular opening. Ultimate yield strength: 40,000 pounds shear and 60,000 pounds tension.
 4. Bolting inserts for cable stanchions: Flared, threaded inserts of non-corrosive, chemical resistant, nonconductive thermoplastic material; 1/2-inch internal diameter by 2.75-inch deep, flared to 1.25-inch minimum at base. Tested ultimate pull-out strength at 12,000pounds minimum.
 5. Expansion anchors for installation after concrete is cast: Zinc-plated carbon steel wedge type with stainless-steel expander cup 1/2-inch bolt size, 5,300 pound rated pull-out strength and 6800pound rated shear strength minimum.
 6. Cable stanchions: Hot-rolled, hot-dipped, galvanized "T" section steel, two 1/4-inches size, punched with 14-holes on 1.5-inch centers for cable arm attachment.
 7. Cable arms: 3/16-inch thick hot-rolled, hot-dipped galvanized sheet steel pressed to

channel shape, approximately two 12-inches wide by 14-inches long and arranged for secure mounting in horizontal position at any position on cable stanchions.

8. Cable support insulators: High glaze, wet-process porcelain arranged for mounting on cable arms.
9. 9. Ground rods: Solid copper, 3/4-inch diameter by 10-feet length (minimum).
10. 10. Ground wire: Stranded bare copper conductor, #6 AWG (minimum). Size in accordance with CEC Article 250.
11. Steps: Cast iron, suitable for shape and construction.

2.6 J-HOOK “NON-CONTINUOUS” CABLE SUPPORT SYSTEM

A. General:

1. J-hooks shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables per ANSI/TIA 568.0-D.
2. J-hooks shall have flared edges to prevent damage while installing cables.
3. J-hook shall have a cable retainer wire form to provide containment of cables within the hanger. The cable retainer shall be removable and reusable.
4. J-hook shall have a hot-dipped galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
5. J-hook shall be made using a metal thickness of 0.052” and in a finish and hardness.
6. Attaching J-hooks and assemblies to ceiling support wires is not allowed per the CEC.

B. Multi-tiered field assemblies:

1. Multi-tiered J-hook assemblies shall be used where separate cabling compartments are required. Assemblies may be created by joining the J-hook with snap-on tree-mounting brackets. Assemblies can be made single-sided for wall-mount applications or single/double sided for ceiling/beam/threaded rod suspended applications. The assembly is rated for indoor use in non-corrosive environments.
2. For installation on threaded rod, a snap-on angle bracket must be added on top of the assembly.
3. If required, the multi-tier J-hook assembly can be attached to snap-on angle or straight brackets riveted to beam clamps, flange clips, angle brackets, etc.

C. Factory assembled multi-tier J-hook assemblies: The assemblies shall be used where separate cabling compartments are required. These assemblies are assembled by the factory. Multi-tier assemblies are available for specific applications including wall mount, ceiling mount, threaded rod mount, and beam/flange mount. The beam/flange mount assembly shall include a beam clamp rated to hold the weight of any of the multi-tier configurations. Assemblies shall be available in 1, 2, 3, & 4 tier double-sided and 2, 3, & 4 tier in single-sided configurations. The assembly shall be rated for indoor use in non-corrosive environments.

- D. J-hook assemblies shall be furnished with appropriate fittings and add-on devices to allow for supports in multiple applications. Support fittings and add-on devices include beam or flange fasteners, threaded rod fasteners, support wire fasteners, construction channel support fasteners, wall or concrete or joist fasteners, raised access floor pedestal supports, etc.
- E. J-hook assemblies from acoustic tee bar: Acoustical tee bar bracket riveted to one 1" J-hook, factory assembled; rated for in-door use in non-corrosive environments. Request permission from local AHJ before using.
- F. Finishes: ASTM B633 Standard Specification for Electro-Deposited Coatings of Zinc on Iron and Steel, or ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process
- G. Material: Base material of the J-hooks shall be metal (at least a 0.052" thickness). Any fasteners used to affix the J-hooks shall also be metal and shall be fastened to the metal of the J-hook support.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of pathway installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 3.02 CONDUIT APPLICATION

- A. Electrical metallic tubing (EMT): Shall be used exposed or concealed for interior communication conduits 4" and smaller, where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces. EMT shall not be installed exposed below 6 feet above the finish floor except within communication rooms or closets.
- B. Rigid non-metallic conduit (PVC): Shall be used in the following applications:
 - 1. Direct burial ducts: Schedule 40, minimum 24-inches below finished grade.
 - 2. Concrete encased ducts: Type EB, minimum 30-inches below finished grade.
 - 3. Below building slab-on-grade: Schedule 40, minimum 4-inches below bottom of slab except that bends and penetrates through floor slab shall be insulated galvanized rigid steel conduit.
 - 4. Below roads and paved surfaces:
 - a. Schedule 80, minimum 36-inches below finished grade.
 - b. Concrete encased type EB or DB, minimum 30-inches below finished grade.
 - 5. Penetrations of building and equipment slabs: Schedule 80 conduit.
 - 6. Slope duct to drain towards vaults and away from building and equipment entrances. Pitch not less than 4-inches per 100-feet.

7. Curved sections in duct lines shall consist of long sweep bends with a minimum radius of 25-feet in the horizontal and vertical directions. The use of manufactured bends is limited to building entrances and equipment stub-ups.
8. For communications conduits, do not exceed a combined bend radius of greater than 180-degrees between pull points.
9. Underground conduit stub-ups to inside of building and exterior equipment shall be Schedule 80 conduit.
10. Make joints in ducts and fittings watertight according to Manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.
11. Terminate duct lines at vaults with end bells spaced 10-inches on center for 5-inch ducts and varied proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10-feet from the end bell without reducing duct line slope and without forming trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrance.
12. Separation between direct buried duct lines shall be 3-inches minimum for like systems and 12-inches minimum between power and communication ducts.
13. Concrete encased ducts:
 - a. Duct lines shall consist of single or multiple duct assemblies encased in concrete. Ducts material throughout the installation.
 - b. Rigid PVC spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 3-inches above bottom of trench during the concrete pour. Spacer spacing shall not exceed 5-feet.
 - c. Provide non-ferrous tie wires to prevent displacement of the ducts during pouring of concrete.
 - d. Separate ducts 3-inches for like systems and 6-inches between power and signal ducts.
14. For direct burial installations install continuous warning strip of heavy gage plastic imprinted "communication ducts below", approximately 12-inch wide at 12-inches above ducts.
15. Mandrel all ducts upon completion of installation and prior to pulling cables.

3.3 PREPARATION

A. Conduit:

1. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
2. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.

3. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.
4. Communications conduits shall not be placed closer than 12-inches to power, a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
5. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.
6. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.
7. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150-feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.
8. Communication conduit bends shall not exceed 180-degrees within any single run of conduit.
9. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated, or specified in the Contract Documents or not.

B. Boxes:

1. Install all outlet boxes flush with building walls, ceilings, and floors.
2. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.
3. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Adjust locations as required by structural conditions and to suit coordination requirements of other trades.
4. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire-rated walls separate boxes by at least 24" and wall stud.
5. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

C. J-hooks:

1. Location of J-hooks shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
2. J-hooks shall not be placed closer than 12-inches to a flue, parallel hot water, steam

line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

3. J-hooks shall not be placed closer than 3-inches to any branch circuit power raceway.

3.4 INSTALLATION

A. Conduit:

1. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
2. Minimum communication conduit size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1-1/4" for interior applications and 2" for exterior and underground applications.
3. All communication conduit sizes indicated on the Drawings are sized for 40-percent fill or less for category 6 or 6A cable. If cable type or size is changed the Contractor shall be responsible for resizing conduits upward to meet a maximum 40-percent fill.
4. In general, all conduit work shall be concealed where possible. Exceptions shall be communication rooms, exposed ceiling areas, and parking garages.
5. Install conduits in complete runs before pulling in cables or wires.
6. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.
7. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.
8. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.
9. In all empty conduits or ducts, install a "True Tape" conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.
10. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).
11. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.
12. A run of communications conduit between terminations at wire pulling points shall not contain more than the equivalent of two-quarter bends (180-degrees, total).

B. Fire-rated cable pathways:

1. Install cable pathways in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
2. Install pathways using mounting plates and gasketing that comes with equipment for the application of each installation.

3. Where multi-gang pathway penetrations occur, use framing hardware brackets recommended by manufacturer for specific applications. Pathways shall be furnished with insert hooks and eye windows to connect units together and align them for multi-gang installations.

C. Boxes:

1. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
2. Locate electrical boxes as indicated on Drawings.
3. Install junction or pullboxes where required to limit bends in conduit runs to not more than 180-degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.
4. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended, or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.
5. Leave no unused openings in any box. Install close-up plugs as required to seal openings.
6. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.
7. Welded outlet boxes shall only be used in concealed interior installations.
8. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.
9. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.
10. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.

D. Vaults:

1. Install precast assembly in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
2. Install cast iron frame and cover. Set frames in paved areas and traffic ways flush with finished grade. Set other frames 1-inch above finished grade.
3. Units shall be installed on a level 12-inch bed of well-tamped gravel or crushed stone.
4. Install drains in bottom of units where indicated.
5. Install removable hardware, including pulling eyes, cable stanchions, cable arms and insulators, as required for installation and support of cable and conductors and as indicated.

6. Do not drill deeper than 3-7/8" for anchor bolts installed in the field. Use a minimum of 2 anchors for each cable stanchion.

E. J-hooks:

1. Install J-hooks in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
2. Support J-hooks every 48-inches or less throughout the cable pathway.
3. J-hook support shall consist of 1/4" to 3/8" threaded rods supported from structure above, to structural wall studs with #10 wood or Tek screws or to #12 ceiling wire (independent of ceiling support) to structure.

3.5 PENETRATIONS

A. Conduit:

1. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:
 - a. Where indicated on the Structural Drawings.
 - b. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size, and position of each penetration.
2. Cutting or holes:
 - a. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
 - b. Provide sleeves or "can outs" for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
 - c. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions, or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
 - d. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.
3. Sealing:
 - a. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.
 - b. Firestop: Where conduits and other communication raceways pass through fire-rated partitions, walls, smoke partitions or floor; install a UL classified fire-

stop material to provide an effective barrier against the spread of fire, smoke, and gases. Completely fill and seal clearances between raceways and openings with the fire-stop material.

4. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.
 - a. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be Schedule 80 PVC conduit.
 - b. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.
 - c. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.
 - d. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.6 3.06 CONDUIT CONCEALED IN CONCRETE

- A. Install conduits approximately in the center of the slab so that there will be a minimum of 1-inch of concrete around the conduits.
- B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.
- C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.
- D. Where nonmetallic conduit or tubing is used, raceways must be converted to EMT conduit before rising above floor.
- E. Make couplings and connections watertight.
- F. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

3.7 UNDERGROUND CONDUIT INSTALLATION

- A. Perform trenching, backfilling and compaction operations as specified in Division 31: Trenching.
- B. Install service utility company underground conduits in strict conformance to each utility company's requirements. Obtain a copy of each utility company's installation guidelines prior to commencing Work.
- C. Tops of conduits shall be as follows unless otherwise noted:

- D. Not less than 18-inches below finished grade.
- E. Not less than 30-inches below roadways, paved parking lots, driveways or any surface subject to vehicular traffic.
- F. Not less than 4-inches below building floor slab for branch circuits. Major feeders and large signal conduits (2" and greater) at not less than 18-inches.
- G. Depth of service utility conduits shall conform to utility company requirements.
- H. Furnish and install specified underground conduit marker 12" above conduits in trenches with all buried conduits.

3.8 3.08 CONDUIT TERMINATIONS AND JOINTS

- A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location.
- B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
- C. Stub-up connections: Extend conduits through concrete minimum of 3" and terminate with insulated bushing.
- D. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction, or outlet boxes.
- E. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:
 - 1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
 - 2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15-inches of slack flexible conduit. Flexible conduit shall have a green copper ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.

3.9 SUPPORTS

- A. Conduit:
 - 1. Provide supports for raceways as specified in Section 270529: Communication Hangers and Supports.
 - 2. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the CEC.
 - 3. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.

4. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.
 5. Fasteners and supports in solid masonry and concrete:
 - a. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - b. After concrete installation:
 - 1) Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8" embedment.
 - 2) Power set fasteners not less than ¼-inch diameter with depth of penetration not less than 3-inches.
 - 3) Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
 6. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.
 7. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- B. Boxes:
1. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.
 2. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16-gauge metal channel bars attached to main ceiling runners.
 3. Support boxes independently of conduit system.
 4. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted luminaires are to be installed from the box.
 5. Support boxes mounted above suspended acoustical tile ceilings, directly from the structure above.

3.10 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean all equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.
- B. Touch-up paint for any marks, blemishes or other finish damage suffered during installation.

END OF SECTION 27 05 28

SECTION 27 05 29
COMMUNICATIONS HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Conduit supports.
 - 2. Equipment supports.
 - 3. Fastening hardware.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 05: Miscellaneous metals. Hangers for communication equipment.
 - 2. Division 09: Ceiling suspension systems. Slack support wires.

1.2 REFERENCES

- A. A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. 1. Underwriters Laboratories, Inc. (UL):

UL 2239; Hardware for the Supports of Conduit, Tubing and Cable.

1.3 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections for support of communication equipment furnished and installed under Division 27.
- B. B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communications Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- A. A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Concrete fasteners:
 - a. Phillips "Red-Head".
 - b. Remington.
 - c. Ramset.
 - 2. Concrete inserts and construction channel:
 - a. Unistrut Corp.
 - b. GS Metals "Globe Strut."
 - c. Thomas & Betts "Kindorf" Corp.
 - 3. Conduit straps:
 - a. O-Z/Gedney.
 - b. Erico "Caddy" Fastening Products.
 - c. Thomas & Betts "Kindorf" Corp.
- B. Substitutions: Under provisions of Section 270010: Basic Communications Requirements.

2.2 CONCRETE FASTENERS

- A. Provide expansion-shield type concrete anchors.
- B. Provide powder driven concrete fasteners with washers. Obtain approval by Architect and Structural Engineer prior to use.

2.3 CONCRETE INSERTS

- A. A. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of 1/4" to 1/2" diameter thread for rod support.

2.4 THREADED ROD

- A. Provide steel threaded rod, sized for the load unless otherwise noted on the Drawings or in

the Specifications.

2.5 CONSTRUCTION CHANNEL

- A. A. Provide 1.5-inch by 1.5-inch (nominal), 12-gauge galvanized steel channel with 17/32-inch diameter bolt holes and 1.5-inch on center in the base of the channel.

2.6 CONDUIT STRAPS

- A. One-hole strap, steel, or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.
 - 1. Use malleable strap with spacers for exterior and wet locations.
 - 2. Use steel strap without spacers for interior locations.
- B. Steel channel conduit strap for support from construction channel.
- C. Steel conduit hanger for pendant support with threaded rod
- D. Steel wire conduit support strap for support from independent #12-gauge hanger wires.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of supporting device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Coordinate size, shape, and location of concrete pads with Division 03, Cast-in-place concrete.
- B. B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.

3.3 3.03 INSTALLATION

- A. Furnish and install supporting devices as noted throughout Division 27.
- B. Telecommunication devices and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.
- C. Fasten hanger rods, conduit clamps, outlets, and junction boxes to building structure using precast inserts, expansion anchors, preset inserts, or beam clamps.
- D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.
- E. Use expansion anchors or preset inserts in solid masonry walls.
- F. Use self-drilling anchors, expansion anchor or preset inserts on concrete surfaces.

- G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.
- H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.
- I. Do not drill structural steel members unless first approved in writing by the Architect or Structural Engineer.
- J. Fabricate supports from structural steel or steel channel, rigidly welded, or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- K. Install surface-mounted cabinets with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.
- L. Bridge studs top and bottom with channels to support flush mounted cabinets in stud walls.

3.4 ERECTION OF METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

3.5 WOOD SUPPORTS

- A. Cut, fit, and place wood nailers, blocking and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.6 ANCHORAGE

- A. All floor mounted, free standing telecommunications equipment such as racks and cabinets etc., shall be securely fastened to the floor structure.
- B. Anchorage of communication equipment shall comply with the seismic requirements as outlined in Section 270010: Basic Communication Requirements.

END OF SECTION 27 02 29

SECTION 27 05 36
COMMUNICATIONS CABLE RUNWAYS AND TRAYS

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Cable runways.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. National Electrical Manufacturer Association (NEMA):

NEMA VE 1; Cable Tray Systems
 - 2. American Society for Testing Materials (ASTM):

ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A510 General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

ASTM A633 Electrodeposited Coatings of Zinc and Steel

1.3 SYSTEM DESCRIPTION

- A. Cable runways shall be placed in telecommunication rooms around the perimeter of the room and over equipment racks.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communication Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing, and physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instruction: Provide written instructions for cable tray and runway products special installation techniques.

4. Complete bill of material listing all components.
5. Shop Drawings: Indicate layout, dimensions, support locations and mounting details.
6. Furnish structural calculations for equipment support as described in Section 270010: Basic Communication Requirements.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 270010: Basic Communications Requirements, to include the following.
 1. Instructions for routine maintenance to include bolt-tightening procedures.
 2. Pictorial parts list and part numbers.
 3. Telephone numbers for the authorized parts and service distributors.

1.6 1.06 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Cable Runway:
 - a. Chatsworth Product Inc. (CPI).
 - b. Cooper/B-Line Systems, Inc.
 - c. Belden cable
 - d. Panduit
 - e. Mono-Systems, Inc.
- B. Substitutions: Under provisions of Section 270010: Basic Communications Requirements.

2.2 CABLE RUNWAY SYSTEM

- A. Cable runway shall be used to convey cable within the telecommunication rooms, above equipment racks, plywood backboards at room perimeter, and vertically on walls above conduit sleeves for cable routing to overhead or between floors.
- B. Cable runway shall be ladder type and consist of two longitudinal members (stringers) with

transverse members (rungs) welded to the stringers. Rungs shall be spaced 9-inches on center. Rung spacing in radius fittings shall be 9-inches measured at the center of the runway width. Rungs shall have a minimum cable bearing surface of 1-inch with rounded edges. No portion of the rungs shall protrude below the bottom plane of the side rails.

- C. Straight cable runway sections shall have side rails fabricated as tubular steel channels. All straight sections shall be supplied in standard 10-foot lengths, except where shorter lengths are permitted to facilitate cable runway assembly lengths as shown on drawings.
- D. Cable runway widths shall be 12 or 24-inches as indicated on drawings.
- E. Splice plates shall be the bolted type. The resistance of fixed splice connections between an adjacent section of cable runway shall not exceed .00033ohm. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing the cable runway rated loading capacity.
- F. All splice materials shall be made of ASTM A570 structural steel using carriage bolts and serrated flange locknuts. Hardware shall be powder coated black.
- G. Cable runway supports shall be placed so that the support spans do not exceed a maximum span of 5-feet. Supports shall be constructed from formed shape channel members 1-5/8" by 1-5/8" with necessary hardware such as trapeze support kits, ceiling support kits, triangular support brackets, wall angle support kits, cable drop outs, etc., as provided by the same manufacturer.
- H. Trapeze hangers shall be supported by 5/8" (minimum) diameter all thread rods. All thread rods shall be equipped with threaded rod covers to protect cable from damage during installation.
- I. Accessories shall be furnished as required to protect, support, and install cable runway systems. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed runway drop-outs, barriers, etc.
- J. All cable runway, splice hardware, and support hardware shall be powder coated black.
- K. Loading capacities shall meet NEMA class designations 8A.
- L. Ground bonding:
 - 1. All cable runway shall be bonded with a #6 copper wire with a green jacket to the ground bus bar in room.
 - 2. All sections of the runway shall be bonded with #6 ground straps.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of cable runway and tray installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

- A. Location of cable runway and tray shall be planned in advance of the installation and

coordinated with ductwork, plumbing, electrical, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment. Provide offsets as required to avoid obstruction of cable tray with other trades.

- B. Exposed cable runways and trays shall be run parallel or at right angles to the centerlines of columns and beams.
- C. Cable runways and trays shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
- D. Cable runway and tray shall not be placed closer than 3-inches to any branch circuit power raceway.

3.3 INSTALLATION

- A. Install cable runway and tray in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Installation shall conform to NEMA VE 1 requirements.
- C. Cable runway:
 - 1. All cable runways will be installed in the telecommunication rooms only.
 - 2. Install cable runway in compliance with requirements of CEC, and applicable portions of NFPA 70b and NECA's "Standards of Installation" pertaining to general communication installation practices.
 - 3. All cable runway shall be supported from the structure and at top of cabinets. Horizontal runway shall not be supported from the wall.
 - 4. Provide dimensional structural restraints around the cable runway for transverse and longitudinal bracing.
 - 5. Coordinate cable runway with other work as necessary to properly interface installation of cable runway work with other trades.
 - 6. Provide sufficient space encompassing cable runways to permit access for installing and maintaining cables.
 - 7. Ground all cable runway to the communications room ground bus bar. Use ground straps between each section of runway installed or where splice plates are used to join sections. Scrape paint away from cable runway at points of connection to each section of runway by the ground strap..

END OF SECTION 27 05 36

SECTION 27 05 53
COMMUNICATIONS IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Equipment rack and cabinet nameplates.
 - 2. Fuse protector labels.
 - 3. Vertical and horizontal wire management labeling.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI) / Telecommunications Industry Association (TIA):
 - ANSI/TIA-606-C; Administration Standard for Telecommunications Infrastructure
 - 2. Electronics Industries Alliance (EIA):
 - EIA 230; Color Marking of Thermoplastic Wire.
 - 3. Telecommunications Industry Association (TIA) / Electronics Industries Alliance (EIA):
 - TIA/EIA-606-A; Administration Standard for Commercial Telecommunications Infrastructure

1.3 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein.
 - 2. Schedules for nameplates to be furnished.

1.4 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Equipment rack and cabinet nameplates:
 - a. Chatsworth Product Inc. (CPI).
 - b. Cooper/B-Line Systems, Inc.
 - c. Great Lakes.
 - d. Panduit.
 - e. Ortronics.
 - f. Middle Atlantic
 - 2. Vertical and horizontal wire management labeling:
 - a. Chatsworth Product Inc. (CPI).
 - b. Cooper/B-Line Systems, Inc.
 - c. Panduit.
- B. Substitutions: Under provisions of Section 270010: Basic Communications Requirements.

2.2 NAMEPLATES FOR EQUIPMENT AND RACKS

- A. Engraved, plastic laminated labels, signs, and instruction plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20 square inches or 6-inches in length and 1/8-inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.
- B. Color and letter height as specified in Part 3: Execution.

2.3 BACKBONE COPPER CABLING

- A. Labels type shall be durable plastic (PE or equal) tags, suitable for indoor and/or outdoor use, and shall contain UV inhibitors.
- B. Tags shall attach to the cable via an integrated tie or via a separate steel or plastic tie wrap.
- C. Machine printable with laser printer. Area shall be 1.50" by 2.62", minimum.
- D. Color: Gray tags with white tie-wraps for indoor locations and black tie-wraps for outdoor locations.

2.4 VERTICAL AND HORIZONTAL CABLE LABELS

- A. Fiber optic, twisted pair cables.
- B. Self-laminating adhesive laser labels.
- C. Machine printable with laser printer.
- D. Color: White with black lettering

2.5 OUTLET DEVICE COVERPLATES

- A. Self-laminating, type-on-tape, adhesive labels.
- B. Imprinted or thermal transfer characters onto tape lettering system.
- C. Tape trimmer.
- D. Matte finish spray-on clear coating.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 NAMEPLATES

- A. Installation:
 - 1. Degrease and clean surfaces to receive nameplates.
 - 2. Install nameplates parallel to equipment lines.
 - 3. Secure nameplates to equipment fronts using machine screws.
- B. Provide type 'NP' color coded nameplates that present, as applicable, the system and equipment designations.
- C. Nameplates for telecommunication systems equipment and devices are to be black.

3.3 BACKBONE CABLING

- A. General requirements:
 - 1. Labeling, label colors, and identifier assignments shall conform to ANSI/EIA-606-C and TIA/EIA-606-A Administration Standards and as approved by the Owner.
 - 2. Provide permanent and machine-generated labels.
- B. Backbone cable labeling:

1. Cables:

- a. Text color shall be black with #10 font size.
- b. Identifier assignment:
 - 1) First field: Type of cable.
 - 2) Second field: Total number of pairs.
 - 3) Third field: Cable number.
 - 4) Fourth field: Active cable count and "dead" pairs.
 - 5) Fifth field: Source and destination.
 - 6) Sixth field: Terminal number (MPOE, MDF, IDF).
- c. Label installation:
 - 1) Provide labels on both ends of cables.
 - 2) Install such that they are visible by a technician from normal stance.
 - 3) Fully wrap label around the cable jacket (self-lamination).
 - 4) Provide one label within 12" of the termination apparatus.
 - 5) Provide one label at the point where the cable enters/exits the equipment room.
 - 6) Provide one label at the approximate mid-point between where the cable enters/exits the room and the termination apparatus.

2. BEP terminals:

- a. Text color shall be black with #10 font size.
- b. Identifier assignment:
 - 1) First field: Building identifier.
 - 2) Second field: Building zone identifier.
 - 3) Third field: Incoming cable pair identifier.
 - 4) Fourth field: Outgoing cable pair identifier.
- c. Label installation:
 - 1) Install labels such that they are visible by technician from normal stance.
 - 2) Provide one label on the terminal cover or housing.

3. Fiber patch panels:

- a. Text color shall be black, #10 font size.
 - b. Label installation:
 - 1) Provide labels at each port.
 - 2) Install labels into label window.
4. Label installation in manholes/vaults/pullboxes:
 - a. Provide at least one label within the manholes/vaults/pullboxes.
 - b. Install labels such that they are visible by technician from above grade.
5. Label installation at splice points:
 - a. Provide one label on each side of splice case.
 - b. Install labels such that they are visible by technician from above grade.

3.4 EQUIPMENT RACKS AND CABINETS

- A. Labeling and identifier assignments shall conform to the TIA-606 Standard and as approved by the Owner before installation.
- B. Provide two label nameplates per rack. Permanently affix label nameplates centered on the rack's front top angle and back top angle.
- C. Provide two label nameplates per cabinet. Permanently affix label nameplates centered at the top of cabinet's front door and back door.

3.5 CABLING AND INSCRIBED DEVICE COVERPLATE

- A. General:
 1. Lettering type: Helvetica, 12-point or 1/8" high.
 2. Color of characters shall be black.
 3. Locate the top of the inscription 1/2" below the top edge of the coverplate.
 4. Inscription shall be centered and square with coverplate.
- B. Application:
 1. Provide inscribed coverplates for devices as outlined below:
 - a. Telecommunication outlets.
 2. Type-on-tape inscriptions shall be provided for the following devices:
 - a. Telecommunication outlets.
 3. Type-on-tape installation:

- a. Tape shall be trimmed to the height of the letters.
- b. Trim tape length to 1/4 inch back from each edge of coverplate.
- c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

3.6 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean all equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.
- B. Touch-up paint for any marks, blemishes or other finish damage suffered during installation.

END OF SECTION 27 05 53

**SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOMS**

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Equipment racks.
 - 2. PDU power strips.
 - 3. Vertical cable management.
 - 4. Horizontal cable management.
 - 5. Plywood Backboards
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI) / Telecommunications Industry Association (TIA):

ANSI/TIA-569-D; Telecommunications Pathways and Spaces.
 - 2. American Society for Testing and Materials (ASTM):

ASTM E84; Surface Burning Characteristics of Building Materials
 - 3. Electronics Industries Alliance (EIA) / Electronic Components, Assemblies & Materials Association (ECA):

EIA/ECA-310-E; Cabinet, Racks, Panels, and Associated Equipment.

1.3 SYSTEM DESCRIPTION

- A. The work under this Section covers the materials, accessories, fasteners, etc., and all labor and services required to buildout the telecommunication equipment rooms per the Drawings and per these Specifications.
- B. Installation includes equipment racks, cabinets, cabling, cable management, cable terminations, plywood backboards, cable runways, and termination hardware to support communications equipment. Although, not all the aforementioned equipment is specified under this Section, but covered elsewhere within Division 27.

- C. Also, the grounding system for bonding of equipment racks, cable runway, entrance conduits, riser conduits, etc. within the communication equipment room is included, but specified under Section 270526: Communication Grounding and Bonding.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communications Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Shop Drawings to include:
 - a. Enlarged equipment room plans of the racks, cabinets, overhead cable runway, and conduit stubs into adjoining spaces.
 - b. Wall and rack elevations with scaled components.
 - 3. Furnish structural calculations for equipment anchorage as described in Section 270010: Basic Communications Requirements.
 - 4. Submit Manufacturer's installation instructions.
 - 5. Complete Bill of Material listing all components.
 - 6. Final test results.
 - 7. Warranty.
- B. Dimensions and configurations of equipment shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.

1.5 OPERATION AND MAINTENANCE MANUALS

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 270010: Basic Communications Requirements, to include the following:
 - 1. A detailed explanation of the operation of the system.
 - 2. Instructions for routine maintenance.
 - 3. Pictorial parts list and part numbers.
 - 4. Pictorial and schematic Electrical Drawings of wiring systems, including operating and safety devices, control panels, instrumentation, and annunciators.
 - 5. Telephone numbers for the authorized parts and service distributors.
 - 6. Include all service bulletins and torque Specifications for all terminations.
 - 7. Final testing report.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this section may be used on the Project unless otherwise submitted.
- C. Manufacturer qualifications: Manufacturer must have a minimum 5 continuous years of experience in design and manufacturing of the materials and equipment specified herein.
- D. Installer's qualifications:
 - 1. Installer must have a minimum 5 continuous years of experience in satisfactory completion for Projects similar in scope and cost. Provide backup information on 5 such Projects.
 - 2. Installer shall possess a current, active, and valid C7 California State Contractors License.
 - 3. All conduit and power shall be performed by a valid C10 California State Contractors License

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Equipment components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to manufacturer at no cost to Owner. Components shall be properly packaged in factory-fabricated containers and mounted on shipping skids.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment per Manufacturer's

1.8 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Equipment Racks:
 - a. Chatsworth Product Inc. (CPI).

- b. Belden Cable
 - c. B-Line
 - d. Panduit
 - 2. Power distribution unit (PDU) power strip:
 - a. APC Series #AP7532, Rack PDU
 - b. Chatsworth Product Inc. (CPI), Rack Unit.
 - c. Tripp-Lite, Rack Unit.
 - 3. Vertical management sections:
 - a. Chatsworth Product Inc. (CPI).
 - b. Panduit.
 - c. Belden.
 - 4. Horizontal management panels:
 - a. Chatsworth Product Inc. (CPI).
 - b. Panduit.
 - c. Belden.
- B. Substitutions: Under provisions of Section 270010: Basic Communications Requirements.

2.2 EQUIPMENT RACKS:

- A. Application: Suitable for the support of termination apparatus, cable and cord management apparatus, network equipment, and other similar equipment within a telecommunication room.
- B. Material: High-strength, lightweight, #6061-T6 extruded aluminum construction or 11-Gauge ASTM A570 steel uprights and ASTM A36 steel angles.
- C. Channel:
 - 1. Size: 3" deep with flanges on each side (double sided).
 - 2. Flange: 1.265" wide by 0.25" thick with mounting holes.
 - 3. Mounting holes: Threaded mounting holes at #12-24 rolled and spaced 5/8", 5/8", 1/2" compatible with ANSI/EIA-310-D.
 - 4. RMU markings: The RMU markings shall be permanently stamped on the outside of both flanges on both channels.
- D. Assembled rack: All equipment racks shall be 2-post, complete with two mounting channels, two base angles (3.5" high by 6" deep by 0.375" thick), four top angles (1.5" high by 1.5"

deep by 0.375" thick. Rack shall be 7'-0" high (overall) by 19" mounting width (20.25" width overall and shall contain 45 EIA mounting spaces (1.75" on center).

- E. Load rating: 1000-lbs, when evenly distributed for the height of rack.
- F. Finish: Powder coat, black.
- G. Accessories: Include required accessories, such as floor installation kits, seismic gusset kits, mounting hardware, etc. for a complete installation.

2.3 WALL CABINET

- A. Cabinet System is designed for use in computer and equipment room applications primarily as a storage solution for network cabling and switch equipment. Product webpage:
 - 1. Subject to compliance with requirements, provide Chatsworth Products (CPI); CUBE-IT Wall-Mount Cabinet.
 - 2. Description: Wall-mount cabinets manufactured from steel.
 - 3. Size: As coordinated with useable space requirements selected.
 - a. Equipment Mounting Rails: Two pairs, square punched; spaced horizontally to support 19 inches wide EIA-310-E compliant rack-mount equipment and shall provide 26U or 12U of rack-mount space per bid plans.
 - b. Depth: rack depth shall be 24"
 - c. Front Door: Solid
 - d. Rear Panel: Size: 5 inches deep with cable access via pre-punched knockouts for conduit along the top and bottom edges of the panel.
 - 1) Knockouts: Four 1 inch knockouts for ¾ inch trade size conduit; two on top and two on bottom and ten 3 inches knockouts for trade size 2.5 inch (63.5 mm) conduit; five on the top and five on the bottom.
 - 2) Grommets: Rubberized or plastic/composite which fit within the 3 inch knockouts to protect cables when conduit is not used to route cables.
 - 3) 3) Cutouts: Two 12 inches high by 6 inches wide.
- B. Cabinet System Accessories:
 - 1. Vertical Lashing Bracket: 4 inches (100 mm) wide with an alternating repeating pattern of three vertical columns and two horizontal rows of 1/8 inch (3 mm) by 1 inch (25 mm) lashing points.
 - 2. Size: 12U or 24U for appropriate cabinet.
 - 3. Cable Port Brush Kit: Rectangular brush cover for rear panel knockout is 0.8"H (20 mm) x 10.6"W (268 00) x 2.9"D (74 mm)
 - 4. Fan Kit: Rated for 115 Volts Alternating Current with NEMA 5-15P plug. Standard Fan Kit has airflow of 115 CFM). Low Decibel, Dual-Fan Kit has airflow of 120 CFM (204

CMH)

2.4 PDU POWER STRIP

- A. Provide one PDU horizontal power strips per rack. PDUs shall be rated at 20amps, 120volt, 1-phase, 2-wire plus ground.
- B. PDU shall contain eight NEMA 5-20R receptacles all per wired.

2.5 VERTICAL MANAGEMENT SECTION:

- A. Suitable for cable routing (back), cord routing, and cord slack storage (front) vertically within a rack bay, from bottom of rack to the top.
- B. The vertical management sections shall be double-sided having covered cable guides on the front and flip-retainers on the rear.
- C. Size and capacity between racks: 7'-0" high by 10" wide by 16.15" deep minimum.
- D. Size and capacity at end of racks: 7'-0" high by 6" wide by 16.15" deep.
- E. The vertical management sections shall have matching bolt holes for attachment to equipment rack.
- F. Finish: Black, guide and cover.

2.6 HORIZONTAL MANAGEMENT PANEL

- A. Suitable for installation into equipment rack for horizontal cord management. The horizontal management panel shall match (and fully integrate with) the vertical management sections.
- B. The horizontal management panel shall be double-sided.
- C. Size: 2U, high by 19" mounting.
- D. Finish: Black, guide and cover.

2.7 PLYWOOD BACKBOARDS

- A. Plywood backboards shall be placed on all walls of the telecommunications equipment room to 8'-6"AFF. Bottom of plywood shall be 6"AFF. The plywood will support wall mounted equipment, termination blocks, cable runways, etc.
- B. Plywood backboards shall be A-C grade, fire treated, 3/4" thick by 8' high by 4' wide, void free and sanded one side.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of equipment installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATION

- A. Provide support equipment in telecommunications equipment rooms to support cable infrastructure, network equipment, horizontal cabling, patch cords and entrance cable.

3.3 EQUIPMENT RACKS AND WALL-MOUNTED ENCLOSURES

- A. Installation
 - 1. Equipment racks shall be mounted to the floor using drop-in type anchors.
 - 2. Mount equipment racks per dimensions stated on the construction drawings to allow proper clearances and preserve future growth.
 - 3. Equipment racks shall be mounted square and level.
 - 4. Equipment racks shall be supported laterally by the cable runway which is mounted to the equipment room wall.
 - 5. Each equipment rack shall be grounded to the Telecommunication Grounding Busbar with a dedicated #6 AWG wire. Daisy-chaining racks are not allowed.
 - 6. Wall-mounted enclosures shall be mounted to the wall studs at six places minimum. Pre-drill plywood backboards prior to mounting to assure proper stud anchoring.
 - 7. Wall-mounted enclosures shall be mounted level and mounting rails installed with 6" of clearance to the front of enclosure door.
 - 8. Wall-mounted enclosures shall be mounted so they can swing open with proper clearances. Cables shall maintain proper slack to allow opening of enclosures.
 - 9. Wall-mounted enclosures shall be grounded to an electrical panel ground bus with a #6 AWG wire.

3.4 PDU POWER STRIPS

- A. Install vertical power strips as shown on Drawings or as specified herein. There shall be two vertical power strips per rack or cabinet, located on the back side, one on each side. Install fasteners and parts as required, per manufacturers instructions, as required for proper supports.
- B. Route the input cords within designated cable management and provide cord fasteners to prevent movement of the input cords. Plug the input cords into the receptacle the designated for the purpose.

3.5 CABLE MANAGEMENT

- A. Vertical Managers
 - 1. All equipment racks shall contain vertical managers between racks and on each end of racks.
 - 2. Attach managers securely to equipment racks.
 - 3. Provide cable protection with radius drops or plastic inserts into managers that allow

cables to be free of kinks or cuts.

B. Horizontal Managers

1. All equipment racks shall contain horizontal managers between all patch panels and equipment.
2. Secure managers with at least four rack screws.
3. Utilize managers on the backs of all premises cable equipment racks to properly dress cable terminations.

3.6 3.06 PLYWOOD BACKBOARDS

- A. Plywood shall be 4' by 8' by 3/4" fire-treated with one side sanded.
- B. Plywood shall be installed 4" above finished floor with stamped and sanded side out. Install around all walls of Telecommunications room.
- C. Secure plywood in backing or studs with #12 flat head screws (Wood or STS) as required.
- D. Secure within 2" from edge and 12" on center.

3.7 MISCELLANEOUS EQUIPMENT

- A. For the complete installation of Communication Equipment Rooms, the following equipment would also be required, but are each covered elsewhere in this Division of Work:
 1. Communication cabling.
 2. Communication termination blocks and accessory hardware.
 3. Communication cable runways.
 4. Communication grounding and bonding.
- B. Refer to other Sections of this Division for specific requirements for the installation of the above equipment.

3.8 FIELD QUALITY CONTROL

- A. At least three weeks prior to any testing, notify the University's Representative so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the University's Representative's witnessed test.
- B. Test equipment racks to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. Refer to NFPA70B, Chapter 18, for testing and test methods.
- C. Visual and mechanical inspection:
 1. Visually inspect all rack support hardware and structural supports for loose bolts, nuts and other connection hardware that could cause the mechanical failure of cable support systems.

2. Inspect ground connections to conduits, cable runway, equipment racks, BEP's, backbone cables and bus bars for mechanical integrity of the bond between ground cable and grounded equipment.
 3. Inspect the ground bus between electrical ground and each bus bar in system.
- D. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Owner's Representative's hourly rate.
 - E. Contractor shall replace at no costs to the Owner's, all equipment and devices which are found defective or do not operate within factory specified tolerances.
 - F. Contractor shall submit final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.9 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean all equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.
- B. Touch-up paint for any marks, blemishes or other finish damage suffered during installation.

END OF SECTION 27 11 00

**SECTION 27 13 13
COMMUNICATIONS BACKBONE COPPER CABLING**

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Outside Plant (OSP) backbone twisted pair cable.
 - 2. Building entrance fused protector blocks.
 - 3. Backbone cable terminations.
 - 4. Cross-connect wiring.
 - 5. Cable testing equipment.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI) / Insulated Cable Engineers Association (ICEA):
 - ANSI/ICEA S-90-661; Category 3, 5, and 5e Individually Unshielded Twisted Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems.
 - ICEA S-102-700; Standard for Category 6 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for Use in Communication Wiring Systems Technical Requirements.
 - 2. American National Standards Institute, Inc. (ANSI) / Telecommunications Industry Association (TIA) / Electronics Industries Alliance (EIA):
 - ANSI/TIA/EIA-758; Customer-Owner Outside Plant Telecommunications Cabling Standard (TIA/EIA-758-1: Addendum No. 1).
 - 3. Electronics Industries Alliance (EIA):
 - EIA 230; Color Marking of Thermoplastic Wire.
 - 4. National Fire Protection Agency (NFPA):
 - NFPA 255; Standard Method of Test of Surface Burning Characteristics of Building Materials

NFPA 259; Standard Test Method for Potential Heat of Building Materials

NFPA 262; Standard Method of Test for Flame Travel and Smoke of Wires and Cables for use in Air-Handling Spaces

5. Telecommunications Industry Association (TIA) / Electronics Industries Alliance (EIA):

TIA/EIA-568-C.2; Balances Twisted Pair Telecommunications Cabling and Components Standards

TIA 569; Telecommunications Pathways and Spaces

6. Underwriters Laboratories, Inc. (UL):

UL 444; Communications Cables

UL 497; Protectors for Paired-Conductor Communication Circuits

UL 497A; Secondary Protectors for Communication Circuits

UL 497B; Protectors for Data Communications and Fire Alarm Circuits

UL 1863; Communication-Circuit Accessories

1.3 SYSTEM DESCRIPTION

A. Provide a complete copper backbone cabling system installation as specified herein and as shown on the Drawings. In general, system shall include, but not be limited to, the following:

1. OSP backbone twisted pair cabling:

a. OSP cable shall be routed underground in PVC conduit(s) between buildings from the main distribution facility (MDF) cross-connect room of one building to the BDF rooms of other buildings, in a star topology, and shall consist of one multi-conductor pair, Category 3, UTP, OSP, filled copper cable.

b. Provide Splice cases in manholes and/or vaults to distribute inter-building copper cable to buildings.

c. Provide splice cases for transitioning between filled OSP cable and ISP riser cable prior to termination on punchdown blocks in MDF, BDF, entrance room (ER), or MPOE for service entrances.

d. Terminate backbone twisted pair cables on Category 3, wall-mounted, 110 style, BEP blocks at the MPOE or ER or MDF or BDF.

e. Terminate copper backbone cables on Category 5, wall-mounted, 110 style punchdown blocks at the MPOE or ER, MDF, BDF and IDF/TR rooms.

f. Include cross-connect cabling for 33% of the riser to each IDF/TR at the MDF or BDF. Cross-connect the site entrance cable to the riser cable.

g. Include cross-connect cabling between 110 block backbone field and 110 block voice/patch field.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communication Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Describe system operation, equipment, dimensions and indicate features of each component.
 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 4. Shop Drawings prepare in Revit, to include the following:
 - a. Site plans indicating the cable origination, destination for each cable, and splice points. Drawings shall indicate cable pair count, cable pair splice count, cable spare pair count.
 - b. Building floor plans showing location of all outlets and cable routing to each device at same scale as construction documents.
 - c. Riser diagram(s) indicating all major components of copper cabling system with required cable inter-ties and backbone cable identification labels.
 - d. Provide 1/4" scale plans of equipment layout in MPOE, ER, MDF, BDF, and IDF/TR rooms.
 - e. Provide wall elevations of MPOE, ER, MDF, BDF, and IDF/TR rooms at 1/4" scale.
 - f. Provide equipment rack elevations at 1/4" scale.
 - g. Use identical symbols as those used in construction documents.
 - h. Text shall be a minimum of 3/32" high when plotted at full scale.
 - i. Screen all background information.
 - j. Splice case mounting details in manholes, vaults. And equipment rooms.
 5. Furnish structural calculations for equipment anchorage as described in Section 270010:

Basic Communication Requirements.
 6. Submit Manufacturer's installation instructions.
 7. Complete Bill of Material listing all components.
 8. Final test results.
 9. Warranty.

- B. Dimensions and configurations of equipment shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout, if equipment furnished varies in size from that indicated on Drawings, for approval.

1.5 OPERATION AND MAINTENANCE MANUALS

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 270010: Basic Communication Requirements, to include the following:
 - 1. A detailed explanation of the operation of the system.
 - 2. Instructions for routine maintenance.
 - 3. Pictorial parts list and part numbers.
 - 4. Schematic wiring diagrams.
 - 5. Telephone numbers for the authorized parts and service distributors.
 - 6. Include all service bulletins and torque Specifications for all terminations.
 - 7. Final testing report.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Installer's qualifications: Installing contractor shall have 5-years of experience in the installation of copper backbone cabling systems. Experience shall include copper cable splicing, terminating, and testing of multi-pair cables. The contractor shall possess a valid C7 California State Contractors License.
- D. All conduit work shall be installed by a valid C10 California State Contractors License.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Equipment components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to manufacturer at no cost to Owner. Components shall be properly packaged in factory-fabricated containers and mounted on shipping skids.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

- A. Units and components offered under this Section shall be covered by a 10-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

- 1. Backbone cables and termination blocks:
 - a. Superior Essex Cable
 - b. General Cable
 - c. CommScope
 - d. Belden Cabling System
- 2. 2. Splice case 710 modules:
 - a. 3M
 - b. AT&T
- 3. Building Entrance Protectors:
 - a. Circa
 - b. Porta Systems
 - c. Systemax
- 4. Cable test equipment:
 - a. Fluke Networks
 - b. Agilent Technologies WireScope 350 Test Set
 - c. Tektronix

- B. Substitutions: Under provisions of Section 270010: Basic Communication Requirements.

2.2 OSP BACKBONE TWISTED PAIR CABLE

- A. Application:
 - 1. Suitable for outdoor installations in underground PVC conduits.
 - 2. Each cable run shall be a continuous single cable, homogenous in nature, without splices.

3. Twisted pair type cable with filled core and ASP sheath, compatible with Bell System type ANMW or Rural Utilities Service type PE 89.

B. Conductors:

1. Annealed solid copper, #24 AWG.
2. Fully insulated conductors consisting of an inner layer of expanded polyolefin and covered with an outer layer (skin) of solid polyolefin.
3. Multi-conductor Category 3 cable.
4. Conductors shall be twisted into pairs. Twisted pairs shall be stranded into 25-pair bundles and into larger units of 25-pair increments, to make up the specified pair count, as well as super units (if required by pair count).
5. Twisted pairs and units shall be color-coded to industry standards per EIA 230.

C. Core and sheath:

1. Cable core (twisted pairs) shall have a tape applied longitudinally, wrapped around its entirety. Tape material shall be non-hydroscopic polypropylene film or equivalent.
2. Cable core and sheath shall be flooded with filling compound "FLEXGEL," or equal, to protect against moisture penetration.
3. Sheath type shall be "ASP" consisting of a two-layer inner shield and an outer jacket:
 - a. Shield:
 - 1) 0.008" corrugated aluminum tape applied longitudinally over the core wrap.
 - 2) 0.006" corrugated steel tape applied longitudinally over the aluminum tape with an overlap.
 - b. Jacket: Black, linear low-density polyethylene, bonded to shield.

D. Splice case modules:

1. Modules shall contain an insulation displacement connection (IDC) device. The electrical connections are made by metallic contact elements that displace the insulation, creating a contact point between the conductor and the contact element.
2. The module design provides a gas-tight connection.
3. Strain relief is achieved through plastic sheath retention grip points, maintaining retention on conductor insulation.
4. Modules shall accommodate 25-pairs of PIC or PVC insulated copper twisted-pair conductors, gel-filled OSP type, in sizes ranging from #22 to #26 AWG.
5. Module shall be constructed of flame-retardant engineering grade plastic. Each module contains its own moisture-resistant compound that is pressed outward when the body and index strip or cap are pressed together. The preloaded compound is

designed to fill all voids to eliminate air or moisture pockets that could surround the contacts and/or conductors.

2.3 BUILDING ENTRANCE PROTECTORS (BEP)

- A. Provide protection of equipment and personnel from power surges and lightning strikes via termination of outside plant cables to building entrance protection "BEP" blocks.
- B. BEP terminals:
 - 1. Suitable for indoor installations, within equipment rooms (such as MPOE, ER, MDF and BDF). Provide termination of outside plant twisted pair backbone cables to BEP terminals to protect premise equipment against induced voltages and stray currents. BEP terminals shall accept 5-pin protector modules.
 - 2. BEP terminals shall be designed for wall mounted configurations and shall have the capacity to accept 50 to 100-pair incoming and/or outgoing cable pairs.
 - 3. 710-type input splice modules.
 - 4. 25 pair BEP output cables to 110 blocks.
- C. BEP modules:
 - 1. Standard 5-pin type BEP, suitable for installation into BEP terminals.
 - 2. Gas tube overvoltage device with DC breakdown voltage of 230-350V.
 - 3. Heat coil sneak current device with 1.0amp of sneak current and response time less than 15-seconds.

2.4 BACKBONE TWISTED PAIR TERMINATIONS:

- A. Outside plant cables: Terminate all OSP cables to building entrance protection "BEP" blocks. Refer to Specification Section 271100: Communication Equipment Rooms for BEP requirements.

2.5 CROSS-CONNECT WIRES:

- A. Cross-connect wires shall be suitable for installation within the MPOE, ER, MDF, BDF, and IDF/TR, and shall be fully compatible with the termination apparatus specified within this Section.
- B. Cross-connect wires shall be manufactured from a single, continuous length of insulated wire, homogenous in nature. Splices are not permitted anywhere.
- C. Conductors:
 - 1. Insulated conductors: #24 AWG, solid copper wire insulated with thermoplastic polyethylene or high-density polyolefin for non-plenum rated applications.
 - 2. Twisted pairs: Two insulated conductors twisted together to form a pair with individually color-coded pairs to conform to industry standards (EIA-230).

2.6 CABLE TESTING EQUIPMENT

- A. Equipment shall meet TIA/EIA-568C.2 Addendum 1 requirements for Level III accuracy, as applicable for cable type specified herein.
- B. Test standards: ISO/IEC 11801 Class C and D; ISO/IEC 11801-2000 Class C and D, 1000Base-Y, 100Base-TX; IEEE 802.3 10Base-T; ANSI TP-PMD; IEEE 802.5.
- C. Areas of test measurement (minimum):
 - 1. Wire Map.
 - 2. Length.
 - 3. Insertion Loss.
 - 4. The following at both master unit and remote unit:
 - a. Near End Crosstalk (NEXT) loss.
 - b. Power Sum NEXT (PSNEXT) loss.
 - c. Equal Level Far End Crosstalk (ELFEXT).
 - d. Power Sum ELFEXT.
 - e. Return Loss (RL).
 - f. Attenuation-to-Crosstalk Ratio (ACR).
 - g. Power Sum ACR (PSACR).
 - 5. Propagation Delay and Delay Skew.
 - 6. Characteristic Impedance.
 - 7. DC Loop Resistance.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of the backbone cabling system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are satisfied.
- B. Verify that pathways and supporting devices are properly and completely installed prior to cable installation.
- C. Verify dimensions of pathways to include length, i.e. "true tape" conduit runs.
- D. Prior to installation, verify that the MPOE, ER, MDF, BDF, and IDF/TR rooms are ready to accept cables and terminations.

3.2 INSTALLATION

A. OSP backbone twisted pair cabling:

1. Cabling:

a. Cable runs shall have continuous sheath continuity, homogenous in nature, between either termination points or designated splice points. Only splices as noted on the Construction Documents are permitted.

b. Maximum cable length of 4,900 feet between the termination points.

c. Placement:

- 1) Place cables within designated pathways.
- 2) Maintain a minimum bend radius of 30 times the cable diameter during and after installation. Follow manufacturers specifications.
- 3) Maintain pulling tension within manufacturer's limits. Only use UL approved cable pulling compounds when necessary to reduce pulling tensions.
- 4) Place and suspend cables in a manner to protect them from physical interference or damage. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation.
- 5) Neatly dress and organize cables in the cable routing facilities and fasten to support devices via tie wraps.

d. Routing:

- 1) When routing horizontally within equipment rooms, utilize the overhead cable runway system. Within overhead cable support, route backbone cables to avoid crossing over horizontal cabling or horizontal cabling crossing over backbone cables. When routing vertically within equipment rooms, utilize the vertical cable support system and provide approved cable straps at 24" intervals.
- 2) Route cables a minimum of 6" away from power sources to reduce interference from EMI.

e. Terminations:

- 1) Properly relieve strain from cables at termination points per manufacturer's recommendations.
- 2) Bond metallic components of the cable sheath (i.e. shield) to the telecommunication ground system in accordance with the CEC and manufacturer's instructions.
- 3) Terminate twisted pairs at both ends onto the specified BEP terminals. Perform terminations in accordance with manufacturer's latest instructions and TIA/EIA-568-C standard installation practices.

2. Building entrance protection:

- a. Provide BEP system to include terminals, modules and accessories required for a complete installation. Install BEP per manufacturer's written instructions.
 - b. Install BEP terminals plumb and square with building lines. Install such that the bottom row of terminations is no lower than 24" above finished floor and the top row of terminations is no higher than 60" above finished floor.
 - c. Grounding and bonding:
 - 1) Bond BEP terminals to the telecommunication ground system in accordance with the CEC and per the manufacturer's instructions.
 - 2) Provide #6 AWG bonding conductor.
 - d. Provide quantity of protector modules to completely populate terminals.
3. Cross Connecting: Provide 1-pair cross connect to 33% of the riser cable at the MDF/BDF and IDF/TR.

3.3 FIELD QUALITY CONTROL AND TESTING

A. General:

1. Calibrate test sets and associated equipment per the manufacturer's instructions at the beginning of each day's testing and after each battery charge. Fully charge the test sets prior to each day's testing to ensure proper operation.
2. Ensure test equipment and test cords are clean and undamaged during testing activities. Per the Owner's Representative discretion, halt testing activity and clean testing equipment, test cords and related apparatus.
3. Permanently record test results electronically within test equipment at the time of testing.

B. Twisted pair testing:

1. Test for UTP cabling as follows:

TESTS FOR TWISTED PAIR CABLE TABLE				
SUBSYSTEM	TYPES	TEST	CONFIGURATION	NOTES
Backbone	OSP	See Notes	Wire map	Length

2. Precautions:

- a. Adhere to the equipment manufacturer's instructions during all testing.
- b. Prior to any testing activity or any measurements taken, ensure the test equipment is at room temperature, approximately 70-degree F.
- c. Fully charge power sources before each day's testing activity.

3. Backbone twisted pair testing:

- a. The installation will be accepted when testing has indicated availability of 100% terminated pairs.

- b. Test continuity and wire map for all pairs.
 - c. Test length for 2% of pairs of each cable. Pairs shall be from different 25 pair binder groups.
- C. Record documents:
 - 1. Permanently record all test results.
 - 2. Export test results' numerical values to a single Microsoft Excel spreadsheet.
 - 3. Submit test results in a format acceptable to the Owner or Owner's Representative before system acceptance.
 - 4. Cable pair identifiers of the test reports shall match the identifiers as labeled in the field, i.e. use the same ID on the cable/termination label as what appears on the test report.
 - 5. Measurements shall carry a precision through one significant decimal place, minimum.
 - 6. Use feet for the units for measurements shown on the print of the test measurements.
 - 7. For each twisted pair backbone cable test, report shall contain the following information:
 - a. Project name and address.
 - b. Test company's and Operator's name.
 - c. Date measurements were taken.
 - d. Test equipment type to include model and serial numbers.
 - e. Cable identification number and pair number.
 - f. Measurement results.

3.4 INSPECTION AND ADJUSTMENTS

- A. Contractor shall inspect all installed Work in conjunction with the General Contractor and develop a "punchlist" for all items needing correction. Provide punchlist to the Owner's Representative prior to their final walk of Project.
- B. Punchlist work and the required remediation shall be performed prior to system final acceptance.
- C. Replace or repair work completed by others that was defaced or destroyed during the installation of the communication cabling system by this Contractor.
- D. Make changes to adjust the system to optimum operation for final use. Contractor is responsible for making changes to the system such that any defects in workmanship are correct and all cables and the associated termination hardware passes the minimum test requirements.

3.5 CLEANING

- A. Remove all unused, excess, and left-over products, to include debris, spills, and installation equipment.
- B. Leave finished work and adjacent surfaces in neat, clean conditions with no evidence of damage.
- C. Legally dispose of debris.
- D. Clean installed products in accordance with manufacturer's instructions prior to final punchlist.

3.6 TRAINING

- A. At the completion of all Work, a period of not less than 16 hours shall be allocated by the Contractor for instruction and training for the Owner Representative. The Cabling Contractor will need to describe how the cable is separated between different patch panels, how cross-connects are made and other basic cable plant management skills.
- B. Contractor shall schedule training with a minimum of 7 days advance notice..

END OF SECTION 27 13 13

SECTION 27 13 23
COMMUNICATIONS BACKBONE FIBER OPTIC CABLING

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. OSP backbone fiber optic cabling.
 - 2. Backbone fiber optic cable terminations.
 - 3. Cable testing equipment.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI) / Telecommunications Industry Association (TIA) / Electronics Industries Alliance (EIA):
 - ANSI/TIA/EIA-568-D; Commercial Building Telecommunications Cabling Standards, including the following: Part 3: Optical Fiber Cabling Components Standard.
 - ANSI/TIA/EIA-598-D; Optical Fiber Cable Color Coding.
 - ANSI/TIA/EIA-606-C; Administration Standard for Commercial Telecommunications Infrastructure.
 - ANSI/TIA/EIA-758-C; Customer-Owner Outside Plant Telecommunications Cabling Standard (TIA/EIA-758-1: Addendum No. 1).
 - 2. Building Industry Consulting Service International, Inc. (BICSI):
 - BICSI (TDMM); Telecommunication Distribution Methods Manual.
 - BICSI; Customer-Owner Outside Plant Design Manual.
 - 3. Insulated Cable Engineers Association (ICEA):
 - ICEA S-83-596; Fiber Optic Premises Distribution Cable.
 - ICEA S-87-640; Fiber Optic Outside Plant Communications Cable.
 - ICEA S-104-696; Standard for Indoor-Outdoor Optical Cable.

4. National Fire Protection Agency (NFPA):

NFPA 255; Standard Method of Test of Surface Burning Characteristics of Building Materials

NFPA 259; Standard Test Method for Potential Heat of Building Materials

NFPA 262; Standard Method of Test for Flame Travel and Smoke of Wires and Cables for use in Air-Handling Spaces

5. Underwriters Laboratories, Inc. (UL):

UL 1651; Optical Fiber Cable.

UL 2024A; Optical Fiber Cable Routing Assemblies.

1.3 SYSTEM DESCRIPTION

- A. Provide a complete communication optical fiber backbone cabling system installation as specified herein and as shown on the Drawings. In general, system shall include, but not be limited to, the following:

1. OSP backbone fiber optic cabling:

a. OSP backbone fiber optic cable shall be routed underground in PVC conduit(s) between the main distribution facility (MDF) room in the Fieldhouse building to the IDF room in Building A. The installed cable shall consist of one 48-strand, singlemode, OSP fiber optic cable. Cable will be armored indoor/outdoor. No innerduct required.

b. OSP backbone fiber optic cable shall be routed underground in PVC conduit(s) between buildings from Building A to each building or field as shown on drawings, in a star topology. The installed cable shall consist of one 6-strand, singlemode, OSP fiber optic cable. Cable will be armored indoor/outdoor. No innerduct required.

c. OSP backbone fiber optic cable shall be routed underground in PVC conduit(s) between from building A to the scoreboard, Press Box and football stadium field pull boxes as shown on drawings, in a star topology. The installed cable shall consist of one 4-strand, singlemode, OSP fiber optic cable. Cable will indoor/outdoor. No innerduct required.

d. OSP backbone fiber optic cables shall terminate on full height rack in the MDF and building A. The cable ends will be fusion spliced to SMF pigtails with manufacturer terminated LC connectors and placed in LC connector plates.

e. OSP backbone fiber optic patch panel field shall interface with ISP backbone fiber optic patch panel field via fiber patch cords between modular connectors on the front side of patch panels.

f. OSP fiber optic cable connector standard shall be Type LC. Connectors shall be

2. Patch cords:

- a. LC to LC duplex fiber patch cords shall be provided to patch between the OSP and ISP fiber cables.
 - b. Provide duplex patch cords as required to patch between backbone fiber optic (LC) and equipment SC/LC/FC connectors, as required. Coordinate with Owner's IT Representative.
- B. Refer to Drawings for complete documentation of above requirements and all additional requirements.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communication Requirements, the following items:
 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Describe system operation, equipment, dimensions and indicate features of each component.
 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 4. Shop Drawings prepare in Revit , to include the following:
 - a. Building floor plans showing location of all outlets and cable routing to each device at same scale as construction documents.
 - b. Riser diagram(s) indicating all major components of fiber optic system with required cable inter-ties and backbone cable identification labels.
 - c. Provide 1/4" scale plans of equipment layout in MDF, and IDF/TR rooms.
 - d. Provide wall elevations of IDF/TR rooms at 1/4" scale.
 - e. Provide equipment rack elevations at 1/4" scale.
 - f. Use identical symbols as those used in construction documents.
 - g. Text shall be a minimum of 3/32" high when plotted at full scale.
 - h. Screen all background information.
 5. Furnish structural calculations for equipment anchorage as described in Section 270010: Basic Communication Requirements.
 6. Submit Manufacturer's installation instructions.
 7. Complete bill of materials listing all components.
 8. Final test results.
 9. Warranty.

- B. Dimensions and configurations of equipment shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout, if equipment furnished varies in size from that indicated on Drawings, for approval.

1.5 1.05 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 270010: Basic Communication Requirements, to include the following:
 - 1. A detailed explanation of the operation of the system.
 - 2. Instructions for routine maintenance.
 - 3. Pictorial parts list and part numbers.
 - 4. Schematic wiring diagrams.
 - 5. Telephone numbers for the authorized parts and service distributor.
 - 6. Include all service bulletins and torque Specifications for all terminations.
 - 7. Final testing reports.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this section may be used on the Project unless otherwise submitted.
- C. Manufacturer qualifications: Manufacturer must have a minimum 5 continuous years of experience in design and manufacturing of the materials and equipment specified herein.
- D. Installer's qualifications:
 - 1. Installer must have a minimum 5 continuous years of experience in satisfactory completion for Projects similar in scope and cost. Provide backup information on 5 such Projects.
 - 2. Installing contractor shall possess a current, active, and valid C7 California State Contractors License.
 - 3. The installer shall be the Manufacturer's certified reseller/installer of the telecommunication equipment provided. Provide evidence of this certification.
 - 4. Conduit Contractor shall possess a current, active, and valid C10 California State Contractors License.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Telecommunication system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipping shall be replaced and returned to Manufacturer at no cost to Owner.

- B. Storage: Store in clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal components damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

- A. OSP fiber and components offered under this Section shall be covered by a minimum 10-year product and application warranty for malfunctions resulting from defects in materials, workmanship and performance as specified by the manufacturer. Warranty shall begin upon acceptance by the owner.

1.9 MAINTENANCE

- A. Maintenance services:
 - 1. Distributor of the major system components shall maintain a replacement parts department and provide testing equipment when needed. A complete parts department shall be located close enough to supply replacement parts within a 4-hour period.
 - 2. Service must be rendered within 4-hours of system failure notification.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The following Manufacturer shall be acceptable and in compliance with the Project scope as specified herein and indicated on the Drawings.
 - 1. Backbone fiber optic cable:
 - a. Corning Cable Systems
 - b. Superior Essex Cable
 - c. BerkTek Cable
 - d. Belden Cabling System
 - e. CommScope
 - f. General Cable
 - 2. Fiber optic terminations:
 - a. Corning Cable Systems
 - b. Ortronics
 - c. Leviton

- d. Belden Cabling System
 - e. CommScope
 - f. Panduit
 - 3. Indoor Fiber Splice Closure
 - a. Corning Cable Systems
 - b. Ortronics
 - c. Leviton
 - d. Belden Cabling System
 - e. CommScope
 - f. Panduit
 - 4. Fiber Splice Trays
 - a. Corning Cable Systems
 - b. Ortronics
 - c. Leviton
 - d. Belden Cabling System
 - e. CommScope
 - f. Panduit
 - 5. Test equipment:
 - a. Corning Cable Systems
 - b. Fluke Networks
 - c. Laser Precision
 - d. Tektronix
- B. Substitutions: Under provisions of Section 270010: Basic Communication Requirements.

2.2 OSP BACKBONE FIBER OPTIC CABLE:

- A. Application:
 - 1. Suitable for outdoors installations in underground PVC conduit, where cable protection against water and moisture entry is required.
 - 2. Optical transmission performance is not significantly affected by environmental fluctuations, installation, or aging.

3. Materials do not evolve hydrogen in quantities that will increase light attenuation.
- B. Singlemode fiber strands:
1. Minimum physical criteria:
 - a. Core diameter: 8.3 μ m.
 - b. Cladding diameter: 125 μ m, $\pm$ 0.7 μ m.
 - c. Core/cladding offset: $\leq$ 0.5 μ m.
 - d. Coating diameter: 254 μ m, $\pm$ 7.0 μ m.
 - e. Coating/cladding concentricity: 12.0 μ m.
 - f. Minimum tensile strength: 100,000psi.
 2. Minimum performance criteria:
 - a. Attenuation: 0.4dB/km at 1310nm and 0.3dB/km at 1550nm wavelengths, maximum.
 - b. Mode field diameter: 8.4 μ m $\pm$ 0.6 μ m at 1310nm and 8.9 μ m $\pm$ 0.6 μ m at 1550nm.
 - c. Cutoff wavelength: $\leq$ 1260nm.
 - d. Dispersion: 8.0ps/nm•km at 1310nm and 2.6 to 6.0ps/nm•km at 1530 to 1565nm.
- C. Buffering:
1. Fibers shall be loosely buffered, either in a core tube or in multiple tubes around central member.
 2. Buffering tube(s) shall be filled with compound to protect against moisture penetration. Filling compound shall be non-hygroscopic and non-nutritive to fungus ("FLEXGEL," or equivalent). The compound shall be easily removed with conventional nontoxic solvents.
 3. Fibers and buffer tube(s) shall be individually color-coded to meet the requirements of ANSI/TIA/EIA-598-A, also reference ANSI/ICEA S-83-596 and EIA-230.
- D. Cable and sheath:
1. Central member: Dielectric rod (glass-reinforced plastic, GRP).
 2. Fillers (where required to maintain circularity): Plastic rods matched to buffer tube diameter.
 3. Water blocking tape: Applied longitudinally over the central member/buffer tube(s)/filler core.
 4. Strength element: The cable shall have an internal strength element such as aramid

yarn.

5. Rip cord: Nylon or similar (to aid splitting the outer jacket).
 6. The cable shall be cover with an aluminum armor conduit.
 7. Outer jacket: The cable shall have a seamless outer jacket, high or medium density polyethylene or equal, applied to and completely covering the internal components (central member, buffer tube(s), fillers, strength element, etc.). The outer jacket shall contain UV inhibitors for stable performance in direct sunlight. The outer jacket shall be non-hygroscopic and non-nutritive to fungus.
 8. Printing: The jacket shall be printed/permanently marked with the manufacturer, sequential length (feet), fiber type, month and year or quarter and year of manufacture.
- E. Tensile strength: The cable shall have a 600-lbs minimum install rated load and 200-lbs minimum long term rated load.
- F. Operating temperature range: -30-degree C to 75-degree C.
- G. Fiber splice trays:
1. Splice trays shall support 12 to 24 fusion splices.
 2. Trays shall be compatible with the splice closure application and product.
 3. Provide the required quantity of fiber trays and splicing materials as required for a complete system.

2.3 BACKBONE FIBER OPTIC TERMINATIONS:

- A. Fiber optic patch panels:
1. Patch panels shall be an enclosed housing for protecting, storing, and organizing the termination of fiber cables and fiber strands. Shall also contain facilities to store fiber slack and provide patch cord management.
 2. Patch panels shall be passive physical equipment and apparatus used in terminating, interconnecting, and cross-connecting fiber optic cabling. Panel shall possess a minimum fire-resistant rating of UL94V-1 and shall conform to existing OSHA Health and Safety Laws.
 3. Patch panels shall come equipped with safety labels such as laser identification or warning labels as required by system considerations.
 4. Panels shall be and 4U high, 19" rack mountable, accepting up to 12 adapter panels with 12 LC ports in each panel. Panels shall contain rear fiber entry slots, wire retainers and fiber storage drums. Furnish with slide out rails for front access and jumper troughs for cable management. Panels shall be suitable for multimode or singlemode fiber optic cable terminations.
 5. Edge IDF Panels shall be and 2U high, 19" rack mountable, accepting up to 6 adapter panels with 12 LC ports in each panel. Panels shall contain rear fiber entry slots, wire retainers and fiber storage drums. Furnish with slide out rails for front access and

jumper troughs for cable management. Panels shall be suitable for multimode or singlemode fiber optic cable terminations.

6. Panels shall be provided with LC couplings for termination of fiber optic cables with matching connectors.
7. Provide patch panel and port quantities as required for cable terminations.
8. Singlemode:
 - a. Materials:
 - 1) Ferrule ceramic (zirconia or alumina) with pre-radiused finish/face.
 - 2) Connector housing: Plastic.
 - b. Connector shall meet or exceed Ultra PC performance.
 - c. Connector shall have an integral strain relief feature, including a bend limiting rear boot.
 - d. Connector shall be installable via either epoxy or anaerobic method.
 - e. Connector type shall be LC.

B. Fiber optic patch cords:

1. Suitable for indoor installations within communication equipment rooms.
2. Cords shall be factory-assembled from a single, continuous length of cordage, homogenous in nature, and terminated at both ends via connectors as required. Splices are not permitted anywhere.
3. Cordage:
 - a. Conductors: 2 optical conductors/strands, matching physical and optical performance parameters of the singlemode cable plant specified above.
 - b. Construction: Mini Zipcord type with strength member (aramid yarn) and jacket of PVC.
 - c. Flame rating: OFN rated or higher, and UL Listed as such.
4. Connectors:
 - a. Singlemode patch cords shall be terminated with either duplex LC Ultra PC connectors at both ends or with a duplex LC Ultra PC connector at one end, for connection with the cable plant, and a connector type configured to match the equipment at other end.

2.4 MISCELLANEOUS COMPONENTS

A. Fiber slack storage rings.

1. Leviton or equal

- a. OSP fiber optic cable: #48900-OFR
 - b. ISP fiber optic cable: #48900-IFR
- B. Velcro cable ties:
- 1. Width: 0.75" or larger.
 - 2. Color: Same color as the cable to which it is being applied.

2.5 CABLE TESTING EQUIPMENT

- A. Fiber optic light source:
- 1. Connection interfaces shall be factory installed.
 - 2. Output shall be continuous wavelengths.
 - 3. The light sources may contain internal lenses, pigtails, and modal conditioners, provided they meet the launch conditions as described in "Post-Installation" Passive Link Attenuation Testing Procedures.
 - 4. Laser-based light source for singlemode fiber testing shall have the following:
 - a. Center wavelength of 1320nm $\pm$ 20nm and 1550nm $\pm$ 20nm
 - b. Special width (FWHM) of $\leq$ 5nm at 1310nm and $\leq$ 5nm at 1550nm.
 - c. Minimum output power level of $\geq$ 3dBm.
- B. Fiber optic power meter:
- 1. Power meter for singlemode testing shall be capable of measuring relative of absolute power (or both) and must be independent of modal distribution.
 - 2. Power meters used must be calibrated and traceable to the National Bureau of Standards.
 - 3. Power meter used shall have the following:
 - a. Dynamic range of 0dBm to -40dBm minimum.
 - b. Accuracy of $\pm$ 0.2dBm.
- C. Fiber optic mandrel:
- 1. Mandrel diameter for 50/125 μ m jacketed (3.0mm) fiber shall be 22mm.
 - 2. Mandrel diameter for 50/125 μ m unjacketed (0.9mm) fiber shall be 25mm.
- D. Fiber optic OTDR:
- 1. Singlemode source module:

Wavelength	Dynamic	Attenuation	Reflective	Loss	Distance

	Range	Deadzone	Deadzone	Resolution	Accuracy
1310nm	40dB	6.0mt	3.5mt	0.001dB	0.1mt
1550nm	28dB	12.0mt	3.5mt	0.001dB	0.1mt

2. Reader software: Windows-based software capable of reading stored traces and is fully functional with the testing equipment.
- E. Fiber optic test cords:
1. Singlemode fiber optic test cords:
 - a. The fiber of the singlemode test cords shall have the core diameter and numerical aperture nominally equal to that of the singlemode fiber optic passive link.
 - b. Test cord length for testing insertion loss: 1m to 5m.
 - c. Connectors of the test cords shall be compatible with the connector types of the light source and the power meter, and with the cabling plant.
 - d. The connectors shall exhibit ≤ 0.5 dB loss per connection @ both 1300 nm and 1550 nm, as measured per FOTP-171 D3. The connectors shall inhibit Fresnel reflections (i.e. have a "PC" finish).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of the telecommunication fiber optic cabling system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.
- B. Verify that pathways and supporting devices are properly and completely installed prior to cable installation.
- C. Verify dimensions of pathways to include length, i.e. "true tape" conduit runs.
- D. Prior to installation, verify that equipment rooms are ready to accept cables and terminations.

3.2 OSP BACKBONE FIBER OPTIC CABLING:

- A. Cabling:
 1. Cable runs shall have continuous sheath continuity, homogenous in nature, between either termination points or designated splice points. Only splices as noted on the Drawings are permitted.
 2. Placement:
 - a. Place cables within designated pathways.
 - b. Maintain a minimum bend radius of 20-times the cable diameter during

installation and a minimum bend radius of 10-times the cable diameter after installation.

c. Maintain pulling tension within manufacturer's limits.

d. Place and suspend cables in a manner to protect them from physical interference or damage. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation.

e. Only use UL approved cable-pulling compounds when necessary to reduce pulling tension.

f. Provide 20- to 30-feet minimum sheath cable slack at each end of the run within the equipment rooms. Store cable slack in the fiber slack storage ring mounted on wall.

g. Place a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of pull rope.

3. Routing:

a. Route cables in innerduct between points of termination throughout entire length, except at the fiber take up reel.

b. Within equipment rooms, neatly dress and organize cables on designated cable routing facilities and fasten cables to routing facilities via tie wraps or Velcro type straps.

c. When routing horizontally within communication equipment rooms, utilize the overhead cable runway system. When routing vertically within equipment rooms, utilize the vertical cable support system and provide approved cable straps at 24" intervals.

4. Terminations:

a. Properly relieve strain from cables at termination points, at or within the fiber optic termination panels, per manufacturer's instructions.

b. Provide breakout kits to furcated fibers from buffer tubes. Provide required accessories and consumables for the complete termination of fiber strands.

Terminate fiber strands at both ends using the specified fiber optic connectors appropriate for the mode type of the fiber. Perform termination in accordance with manufacturer's instructions.

d. Provide 3-feet of unsheathed fiber (tight buffer) slack within the patch panel/termination enclosure at each end of the link. Properly store fiber slack in rear of patch panel into the routing rings, per manufacturer's instructions.

B. Termination apparatus:

1. Provide fully assembled termination patch panels in designated equipment racks, located a top of rack. "Fully assembled" includes installation and mounting components and accessories such as adapter panels, coupling adapters, etc. required for operation.

2. Provide accessories required for proper installation of each termination patch panel, including connector panels and adapters.
3. Termination sequence for rack-mount panels: Terminate fiber optic cables first at upper left-most position and all in sequential strand order.

3.3 FIELD QUALITY CONTROL AND TESTING

A. General:

1. Calibrate test sets and associated equipment per the manufacturer's instructions at the beginning of each days testing and after each battery charge. Fully charge the test sets prior to each day's testing to ensure proper operation.
2. Ensure test equipment and test cords are clean and undamaged during testing activities. Per the Engineer's discretion, halt testing activity and clean testing equipment, test cords, and related apparatus.
3. Permanently record test results electronically within test equipment at the time of testing.

B. Fiber optic testing:

1. Test fiber optic passive links as follows:

TESTS FOR FIBER OPTIC CABLING TABLE				
Subsystem	Type	Test	Direction	Wavelength
OSP Backbone	Singlemode	Characterization passive link insertion loss	Both	1310nm and 1550nm

2. Precautions:

- a. Adhere to the equipment manufacturer's instructions during testing.
- b. Prior to testing activity or measurements taken, complete the following activities:
 - 1) Ensure the test equipment is at room temperature, approximately 70-degree F.
 - 2) Turn the light source and power meter power on for at least 5-minutes.
 - 3) Clean test/launch cords and system cords, if applicable, connectors and the cabling system adapters with a lint-free wipe and 90 percent (or higher) isopropyl alcohol.
- c. Do not power off OTDR's light source during testing activity.
- d. Do not remove launch cord from the OTDR's light source at any time, unless the testing is complete, or the equipment is being put away for the evening or during trouble shooting.
- e. Do not bend the launch cord smaller than 20-times the cord diameter during testing activities, as this may induce loss into the cord reducing the accuracy of

the measurements.

C. Fiber optic characterization testing:

1. Equipment settings/measurement parameters:

a. Index of refraction, to match cable under test fiber parameters, default settings as follows:

1) Singlemode: 1.466 to 1.467 @ 1310nm and 1.467 to 1.4677 @ 1550nm.

b. Pulse width:

1) Singlemode: 10ns for cable lengths up to 6,560-feet (2,000m); 50ns for cable lengths between 6,560-feet (2,000m) and 32,800-feet (10,000m).

c. Backscatter:

1) Singlemode: -74dB @ 1310nm and 1550nm.

d. Event threshold: 0.05dB.

e. Reflection threshold:

1) Multimode: -45dB.

2) Singlemode: -60dB.

f. Fiber break/end-of-fiber: 3dB.

2. Waveform: The waveform shall be real-time and normal density.

3. Obtain measurements using a launch cord connected to the test instrument and the cable under test.

a. The fiber of the launch cord shall match the fiber of the cable under test in physical and performance parameters (i.e. type, core/cladding size, index of reflection, refraction profile, etc.). The fiber of the launch cord should match the fiber of the cable under test in manufacturer and product.

b. Use launch cord length between 25- and 100-meters.

D. Fiber optic passive link insertion loss testing:

1. Test cords performance verification:

a. Connect test cord #1 between the light source and the power meter.

b. The value displayed on the power meter is the Reference Power (Pref) measurement. If the power meter has a Relative Power Measurement Mode, enter this Pref value into the meter. If it does not, hand-write Pref onto the record document for future reference.

c. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.

d. Connect the open end of test cord #1 to an adapter of matching connector type. Connect one end of test cord #2 to the adapter and the other end to the power meter.

e. The value displayed on the power meter is the Power Measurement (Psum). If the power meter is in Relative Power Measurement Mode, the meter reading represents the test cord #2 connection attenuation. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the connection attenuation:

- 1) If Psum and Pref are in the same logarithmic units (dBm, dBu, etc.):
Connection attenuation (dB) = (Psum - Pref)
- 2) If Psum and Pref are in watts: Connection attenuation (dB) = $[10 \times \log_{10} (Psum/Pref)]$
- 3) The measured connection attenuation must be less than or equal to the value found in the Table below.

f. Flip the ends of test cord #2, so that the end connected to the power meter is now connected to the adapter, and the end connected to the adapter is now connected to the power meter.

g. The meter reading is the reversed Psum. Perform the proper calculations if not using Relative Power Measurement Mode.

h. Verify that both connection attenuation measurements are less than or equal to the value found in the following Table:

ACCEPTABLE TEST CORD CONNECTION ATTENUATION	
Cable Type	SC (or other Mini-Connector) Cord
Singlemode	0.30dB Maximum

i. If both measurements are found to be less than or equal to the values found in the Table, then test cord #1 is acceptable for testing purposes. Unacceptable attenuation measurements may be attributable to test cord #1 or #2. Examine each cord with a portable microscope and clean, polish, or replace, as necessary.

j. Repeat this test procedure from the beginning, reversing the test cords in order to verify the performance of test cord #2.

2. Test equipment set-up:

- a. Follow the test equipment manufacturer's initial adjustment and set-up instructions.
- b. If the meter has a Relative Power Measurement Mode, select this mode.
- c. If the meter can display power levels in dBm, select this unit of measurement to simplify subsequent calculations.
- d. Set the light source and power meter to the same wavelength.

3. Singlemode passive link insertion loss testing procedure:
 - a. Determine the launch conditions:
 - 1) Use the launch conditions as described in FOTP-78.
 - 2) Employ a method to remove high-order propagating modes as described in FOTP-77.
 - b. Test method: Perform the passive link insertion loss testing of singlemode fibers according to the "Test Method A.1: One Jumper Reference," per OFSTP-7.
 - 1) After setting up the test equipment and verifying the performance of the test cords, the insertion loss of the passive link segments can be measured.
 - 2) Connect test cord #1 between the light source and the power meter.
 - 3) The meter reading is the Pref. If the power meter has a Relative Power Measurement Mode, enter the Pref value into the meter. If it does not have this mode, then hand-write the Pref for future reference and to be included in the Record Documents.
 - 4) Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
 - 5) Connect test cord #1 to the passive link segment input.
 - 6) At the opposite end of the passive link segment, connect test cord #2 to the link segment input and the power meter.
 - 7) The meter reading is the Psum. If the power meter is in Relative Power Measurement Mode, the meter reading represents the insertion loss. If the meter does not have this mode, perform the following calculation to determine the insertion loss:
 - a) If Psum and Pref are in the same logarithmic units (dBm, dBu, etc.): $\text{Link segment attenuation (dB)} = (\text{Psum} - \text{Pref})$
 - b) If Psum and Pref are in watts: $\text{Link segment attenuation (dB)} = [10 \times \log_{10} (\text{Psum}/\text{Pref})]$
 - 8) Record Psum for inclusion into the record documents.
4. Acceptable measurement values:
 - a. Remove and replace any cabling links failing to meet the criteria described in this Specification, at no cost to the Owner, with cables that prove to meet the minimum requirements.
 - b. The general insertion loss equation for any link segment is as follows:
 - 1) $\text{Insertion loss} = \text{cable loss} + \text{connection loss} + \text{splice loss} + \text{CPR adjustment}.$

- 2) Note: A connection is defined as the joint made by two mating fibers terminated with remateable connectors.

c. Singlemode attenuation coefficients:

- 1) OSP cable loss = Cable length (km) x (0.40dB/km @ 1310nm) or (0.30dB/km @1550nm).
- 2) ISP cable loss = Cable length (km) x (0.650dB/km @ 1310nm) or (0.50dB/km @1550nm).
- 3) Connection loss = (Connection x 0.24dB) + 0.24dB.
- 4) Splice loss = Splices x 0.07dB.
- 5) CPR adjustment = Not applicable for singlemode.

E. Record documents:

1. Permanently record all test results.
2. Export test results' numerical values to a single Microsoft Excel spreadsheet.
3. Submit test results in a format acceptable to the Owner and the Owners Representative before system acceptance.
4. Cable, and fiber identifiers of the test reports shall match the identifiers as labeled in the field, i.e. use the same ID on the cable/termination label as what appears on the test report.
5. Measurements shall carry a precision through one significant decimal place, minimum.
6. Use feet for the units for measurements shown on the print of the test measurements.
7. Print report such that fiber strands of a given cabling link have matching axis scales. The "X" and the "Y" axis shall be the same from report-to-report.
8. The trace of the printed test report shall show the launch cord.
9. For each fiber optic backbone cable test, report shall contain the following information:
 - a. Project name and address.
 - b. Test company's and Operator's name.
 - c. Date measurements were taken.
 - d. Test equipment type to include model and serial numbers.
 - e. Cable identification number, fiber/strand number and fiber type.
 - f. Measurement direction.
 - g. Set-up parameters (i.e. wavelength, pulse width, refractive index, event

- threshold, etc.)
- h. OTDR trace.
- i. Length of fiber.
- j. Overall link loss.
- k. Passive link insertion loss testing:
 - 1) Wavelength.
 - 2) Loss measurement.
- 10. For each cabling link, include either a schematic graphic or a brief narrative accurately describing the test set-up. The description shall include test/launch cord (with length), expected events (connectors, slices, etc.) with expected distances, etc. This information will eliminate many questions the Owner's Representative will have while reviewing the reports.
- 11. For each twisted pair backbone and horizontal cable test, report shall contain the following information:
 - a. Project name and address.
 - b. Test company's and Operator's name.
 - c. Date measurements were taken.
 - d. Test equipment type to include model and serial numbers.
 - e. Cable identification number and pair number.
 - f. Measurement results.

3.4 INSPECTION AND ADJUSTMENTS

- A. Contractor shall inspect all installed Work in conjunction with the General Contractor and develop a "punchlist" for all items needing correction. Provide punchlist to the Owners Representative prior to their final walk of Project.
- B. Punchlist work and the required remediation shall be performed prior to system final acceptance.
- C. Replace or repair work completed by others that was defaced or destroyed during the installation of the telecommunication cabling system by this contractor.
- D. Make changes to adjust the system to optimum operation for final use. Contractor is responsible for making changes to the system such that any defects in workmanship are correct and all cables and the associated termination hardware passes the minimum test requirements.

3.5 CLEANING

- A. Remove all unused, excess, and left-over products, to include debris, spills, and installation

equipment.

- B. Leave finished work and adjacent surfaces in neat, clean conditions with no evidence of damage.
- C. Legally dispose of debris.
- D. Clean installed products in accordance with manufacturer's instructions prior to final punchlist.

3.6 3.06 TRAINING

- A. At the completion of all Work, a period of not less than 4-hours shall be allocated by the Contractor for instruction and training for the Owner Representative. The Cabling Contractor will need to describe how the cable from each cover plate is separated between different patch panels, how cross-connects are made and other basic cable plant management skills.
- B. Contractor shall schedule training with a minimum of 7-days advance notice..

END OF SECTION 27 13 23

**SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING**

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Horizontal twisted pair cabling.
 - 2. Horizontal cable terminations.
 - 3. Cable testing equipment.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Federal Communications Commission (FCC) Regulations:
 - FCC Part 15; Radio Frequency Devices & Radiation Limits.
 - FCC Part 68; Connection of Terminal Equipment to the Telephone Network.
 - 2. Electronics Industries Alliance (EIA):
 - EIA 230; Color Marking of Thermoplastic Wire.
 - 3. American National Standards Institute, Inc. (ANSI) / Telecommunications Industry Association (TIA) / Electronics Industries Alliance (EIA):
 - ANSI/TIA/EIA-568-C; Commercial Building Telecommunications Cabling Standards, including the following:
 - Part 1: General Requirements.
 - Part 2: Balanced Twisted-Pair Cabling Components.
 - Part 2, Addendum 1: Transmission Performance Specifications for 4-Pair 100 Ohm Category 6A Cable.
 - TIA SP 3-4426 (12/28/06 or latest version): Transmission Performance Specifications for 4-Pair 100 Ohm Augmented Category 6A Cable (to be published as TIA-568-C.2-10).
 - ANSI/TIA/EIA-569-A; Commercial Building Standard for Telecommunications

Pathways and Spaces, including the following:

TIA/EIA-569-A-1: Perimeter Pathway Addendum.

TIA/EIA-569-A-2: Furniture Pathway Fill Addendum.

TIA/EIA-569-A-3: Access Floors.

TIA/EIA-569-A-4: Poke-Thru Devices.

TIA/EIA-569-A-6: Multi-Tenant Pathway and Spaces.

TIA/EIA-569-A-7: Cable Trays and Wireways.

ANSI/TIA/EIA-606-C; Administration Standard for Commercial
Telecommunications Infrastructure.

TIA TSB-155; Guidelines for the Assessment and Mitigation of Installed
Category 6A Cabling to Support 10GBase-T.

4. Building Industry Consulting Service International, Inc. (BICSI):

BICSI (TDMM); Telecommunication Distribution Methods Manual.

BICSI (WDRM); Wireless Design Reference Manual.

BICSI (NDRM); Network Design Reference Manual.

5. Underwriters Laboratories, Inc. (UL):

UL 444; Communication Cables.

UL 1690; Data-Processing Cable.

UL 1963; Communications-Circuit Accessories.

1.3 SYSTEM DESCRIPTION

A. Provide a complete telecommunication cabling system installation as specified herein and as shown on the Drawings. In general, system shall include, but not be limited to, the following:

1. Workstation horizontal twisted pair cabling:

a. Horizontal twisted pair cables shall route between the IDF/TR and workstation outlets, and shall consist of Category 6A, 4-pair, UTP, riser rated copper cables.

b. Category 6A horizontal twisted pair cable will support communication devices such as, but not limited to, the following:

1) Data workstations

2) Wireless access points

3) Telephones (VoIP)

COMMUNICATIONS HORIZONTAL CABLING

- 4) Emergency phones
- 5) Fax machines
- 6) AV equipment
- 7) HVAC controls
- 8) Security cameras
- 9) Security alarm panels
- 10) Fire alarm system panels
- 11) Elevator equipment
- 12) Electrical utility meters

c. Category 6A horizontal twisted pair cables for data system applications shall terminate on Category 6A, patch panels for interface with routers/switches.

d. Horizontal twisted pair security cables (surveillance cameras, security intercom, security panels) shall terminate on Category 6A, 19" wide patch panels (24- or 48-ports) with modular 8-pin connector front for interface with Owner furnished routers/switches via Category 6A RJ45-RJ45 patch cords. Patch panels shall have 110 type terminations at rear for horizontal cable terminations.

e. Horizontal wire management shall be provided above and below each patch panel with 2 RU wire managers.

f. Copper jack standard is Category 6A, RJ-45 connectors at patch panels and workstation outlets.

2. Patch cords:

a. UTP patch cords shall match the physical and performance criteria of the specified horizontal twisted pair cable from the same manufacturer. The cords shall be terminated with the following:

- 1) 568A to 568A for data between network switch patch panel. Cord shall be blue in color.
- 2) 568A to 568A to 568A to 568A for data between network switch to Category 6A security patch panel. Cord shall be green in color.
- 3) 568A to 568A to 568A to 568A, Category 6A for data jack to WAP. Cord shall be yellow in color.
- 4) 568A to 568A to 568A to 568A for Category 6A security jack to camera and security panels. Cord shall be green in color.

b. Patch cords shall be furnished in varying lengths as required.

c. Patch cord quantities shall be two patch cords for each Category 6A cable

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installed. This includes one standard line cord at the workstation and one patch cord at the IDF/TR rooms.

- B. Workstation wall outlets:
 - 1. Standard telecommunication outlets shall consist of the following, unless otherwise noted on the Drawings:
 - a. Two horizontal twisted pair cables per outlet. Cables shall be blue in color.
 - b. Single-gang coverplate with 4-ports.
 - c. RJ-45 connector jacks for twisted pair terminations, T568A.
 - d. Blanks as required.
- C. Wireless access point outlets shall consist of the following, unless otherwise noted on the Drawings:
 - 1. Two horizontal twisted pair cables per outlet. Cables shall be blue in color.
 - 2. Two-gang cover plate with 2-ports when wall mounted.
 - 3. 4-11/16" square surface mount box for above ceiling attached to #12 AWG steel wire or wall.
 - 4. Two Category 6A, RJ-45 connector jack for twisted pair terminations, T568A.
 - 5. Blanks as required.
- D. Surveillance camera outlets, above ceiling, shall consist of the following, unless otherwise noted on the Drawings:
 - 1. One horizontal twisted pair cable per outlet. Cable shall be blue in color.
 - 2. 4-11/16" square surface mount box for above ceiling attached to #12 AWG steel wire or wall.
 - 3. One RJ-45 connector jack for twisted pair terminations, T568A.
 - 4. Blanks as required.
- E. Specialty analog telephone (fire alarm system panel, security panel, elevator phones, etc.) outlets shall consist of the following, unless otherwise noted on the Drawings:
 - 1. Two horizontal twisted pair cable per outlet. Cable shall be blue in color.
 - 2. Two port surface mount box (SMB) mounted in enclosure.
 - 3. Two RJ-45 connector jacks for twisted pair terminations, T568A.
- F. Refer to Drawings for complete documentation of above requirements and all additional requirements.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communications Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Describe system operation, equipment, dimensions and indicate features of each component.
 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 4. Shop Drawings prepare in Revit to include the following:
 - a. Building floor plans showing location of all outlets, raceways, cable trays, conduits, and cable routing to each device at same scale as construction documents.
 - b. Provide 1/4" scale plans of equipment layout in IDF/TR rooms.
 - c. Provide wall elevations of IDF/TR rooms at 1/4" scale.
 - d. Provide equipment rack elevations at 1/4" scale.
 - e. Use identical symbols as those used in construction documents.
 - f. Text shall be a minimum of 3/32" high when plotted at full scale.
 - g. Screen all background information.
 5. Furnish structural calculations for equipment anchorage as described in Section 270010: Basic Communications Requirements.
 6. Submit Manufacturer's installation instructions.
 7. Complete bill of materials listing all components.
 8. Final test results.
 9. Warranty.
- B. Dimensions and configurations of equipment shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout, if equipment furnished varies in size from that indicated on Drawings, for approval.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 270010: Basic Communications Requirements, to include the following:
1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.

3. Pictorial parts list and part numbers.
4. Schematic wiring diagrams.
5. Telephone numbers for the authorized parts and service distributor.
6. Include all service bulletins and torque Specifications for all terminations.
7. Final testing reports.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this section may be used on the Project unless otherwise submitted.
- C. Manufacturer qualifications: Manufacturer must have a minimum 5 continuous years of experience in design and manufacturing of the materials and equipment specified herein.
- D. Installer's qualifications:
 1. Installer must have a minimum 5 continuous years of experience in satisfactory completion for Projects similar in scope and cost. Provide backup information on 5 such Projects.
 2. Installer shall possess a current, active, and valid C7 California State Contractors License.
 3. Conduit contractor shall possess a current, active, and valid C10 California State Contractors License.
 4. The installer shall be the Manufacturer's certified reseller/installer of the telecommunication equipment/cable system provided. The certification shall have been completed 60 days prior to project bid date. Provide evidence of this certification.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Telecommunication system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipping shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal components damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 1.08 WARRANTY

- A. Units and components offered under this Section shall be covered by a minimum 25-year product and application warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall be provided from the component manufacturer and shall name the owner on the warranty certificate. Warranty shall begin upon acceptance by the Owner.
- B. Contractor shall provide required drawings, test results, application and any other items required by the manufacturer to produce the required warranty.

1.9 MAINTENANCE

- A. Maintenance services:
 - 1. Distributor of the major system components shall maintain a replacement parts department and provide testing equipment when needed. A complete parts department shall be located close enough to supply replacement parts within a 4-hour period.
 - 2. Service must be rendered within 4-hours of system failure notification.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Structured cable system
 - a. Leviton/BerkTek
 - 2. Category 6A horizontal structured cable systems:
 - a. BerkTek Cable
 - b. Alternate manufacturers cable will not be accepted.
 - 3. Category 6A twisted pair patch cord cable:
 - a. Leviton
 - b. Alternate manufacturers cable will not be accepted.
 - 4. Cable test equipment:
 - a. Fluke Networks.
 - b. Agilent Technologies WireScope 350 Test Set.
 - c. Tektronix.
- B. Substitutions: Under provisions of Section 270010: Basic Communication Requirements.

2.2 HORIZONTAL TWISTED PAIR CABLING

A. Horizontal cables:

1. Application:

- a. Suitable for indoor installations, exposed within equipment rooms, above suspended ceilings and below raised floors in cable trays, hangers or on deck, or within walls. If space is used as an air plenum, cable shall either be plenum rated or installed in EMT conduit.
- b. Each cable run shall be continuous single cable, homogenous in nature, without splices.
- c. Cables shall meet 6A performance criteria.
- d. Cables shall be CMR or CMP rated as required for rating of space.

2. Conductors:

- a. Eight #23 AWG, solid copper wire insulated with FEP for plenum applications or thermoplastic polyethylene or high-density polyolefin for non-plenum rated applications.
- b. Two insulated conductors twisted together to form a pair and four such paired cables to form a unit with individually color-coded pairs to conform to industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).

3. Cable sheath:

- a. Seamless outer jacket, flame-retardant PVC, applied to and completely covering the internal components (twisted pairs).
- b. CMP flame rating according to CEC Article 800, tested to NFPA 262 and UL Listed as such.

4. Electrical performance: Meet or exceed TIA/EIA-568-C.2 for Category 6A, UTP cabling.

5. Color: Cable shall be blue in color.

B. Patch Cords:

1. 1. Application: Suitable for indoor installations within equipment rooms or workstation environments.

2. Cords assembled from a single, continuous length of cordage, homogenous in nature and terminated at both ends via 8-position modular plugs. Splices are not permitted anywhere.

3. Cordage:

- a. Eight #23 AWG, solid copper wire insulated with thermoplastic polyethylene or high-density polyolefin for non-plenum rated applications.
- b. Two insulated conductors twisted together to form a pair and four such paired cables to form a unit with individually color-coded pairs to conform to

industry standards (ANSI/ICEA Publication S-80-576-1994 and EIA-230).

4. Cable sheath:
 - a. Seamless outer jacket, flame-retardant PVC, applied to and completely covering the internal components (twisted pairs).
 - b. CM flame rated according to CEC Article 800, tested to UL listed as such.
5. Electrical performance: Meet or exceed TIA/EIA-568-C.2 for Category 6A, UTP cabling.

2.3 HORIZONTAL CABLE TERMINATIONS

- A. Category 6A data system patch panels:
 1. Terminations of horizontal distribution cable for data and telephone systems shall be made at Category 6A, 1U, 24 port panels or 2U, 48 port panels.
 2. Terminations of horizontal distribution cable for data WAP locations shall be made at Category 6A, 2U, 48 port panels.
- B. Workstation jacks and coverplates:
 1. Outlet coverplates shall be suitable for indoor installations to standard single-gang flush wall mounted outlet box plaster rings and floor boxes.
 2. Outlets:
 - a. Data jacks shall be 8-pin, IDC termination and rated Category 6A.
 - 1) Voice/Data Jack: Blue
 - 2) Security Camera Jack: Green
 - b. WAP data jacks shall be 8-pin, IDC termination and rated Category 6A.
 - 1) WAP jack: Yellow
 - c. Standard wall mounted coverplates:
 - 1) Coverplate shall be single-gang, flush mounted with 4-ports and shall include required accessories.
 - 2) Coverplate shall be white ABS plastic with an ID label window at the top and bottom of the plate.
 - d. Partition furniture mounted coverplates:
 - 1) Coverplates shall have 4-ports and shall include required accessories, such as icons, blank inserts, label windows, and labels.
 - 2) Furniture plate shall match the type furniture installed for a seamless snap in fit to the base knock out of the installed furniture.

- 3) Coverplates shall match the color of the furniture base.

2.4 MISCELLANEOUS COMPONENTS:

- A. Velcro cable ties:
 - 1. Width: 0.75".
 - 2. Color: Velcro cable ties the same color as the cable to which it is applied.
- B. Plenum cable ties:
 - 1. Suitable for use in plenums or air handling spaces.
 - 2. Color: Maroon or other distinctive non-white color.

2.5 CABLE TESTING EQUIPMENT

- A. Equipment shall meet TIA/EIA-568-D requirements for Level III accuracy, as applicable for cable type specified herein.
- B. Test standards: ISO/IEC 11801 Class C and D; ISO/IEC 11801-2000 Class C and D, 1000Base-Y, 100Base-TX; IEEE 802.3 10Base-T; ANSI TP-PMD; IEEE 802.5.
- C. Areas of test measurement (minimum):
 - 1. Wire Map.
 - 2. Length.
 - 3. Insertion Loss.
 - 4. The following at both master unit and remote unit:
 - a. Near End Crosstalk (NEXT) loss.
 - b. Power Sum NEXT (PSNEXT) loss.
 - c. Equal Level Far End Crosstalk (ELFEXT).
 - d. Power Sum ELFEXT.
 - e. Return Loss (RL).
 - f. Attenuation-to-Crosstalk Ratio (ACR).
 - g. Power Sum ACR (PSACR).
 - 5. Propagation Delay and Delay Skew.
 - 6. Characteristic Impedance.
 - 7. DC Loop Resistance.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of the telecommunication cabling system installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.
- B. Verify that pathways and supporting devices are properly and completely installed prior to cable installation.
- C. Verify dimensions of pathways to include length, i.e. "true tape" conduit runs.
- D. Prior to installation, verify that equipment rooms are ready to accept cables and terminations.

3.2 INSTALLATION

- A. Horizontal management panels:
 - 1. Provide the horizontal management panels mounted to racks with one above and one below each patch panel.
 - 2. Provide fasteners and parts required to complete the installation.
- B. Accessories: Provide all accessories as required for a complete installation. Include one bag of rack mounting screws, as come packaged with rack product. Attach the screws directly to the rack, which shall constitute turn-over to the Owner.
- C. Horizontal twisted pair cabling:
 - 1. Horizontal cable installation and routing:
 - a. Cable runs shall have continuous sheath continuity, homogenous in nature with no splicing.
 - b. Cabling shall not exceed a cable length of 295' (90m) from the termination point at the Telecom room to the termination at the workstation outlet, including service slack, when measured using test equipment. The cable length shall be determined by the contractor prior to installing cable with a true tape. Cable lengths exceeding the 295-foot maximum length, shall be brought to the attention of the engineer of record (EOR).
 - c. Place cables within the designated pathways, such as cable tray or basket tray, cable runway, cable hangers, etc. Do not fasten, support or attach cables to other building infrastructures (i.e. ducts, pipes, conduits, etc.), other systems (i.e. ceiling support wires, wall studs, etc.), or to the outside of conduits, cable trays and non-approved pathway systems.
 - d. Place and suspend cables during installation and termination in a manner to protect them from physical damage or interference. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation or termination at no additional cost.

- e. Route cables at 90-degree angles, allowing for bending radius.
 - f. Do not exceed pulling tension of 25-lbs.
 - g. Do not use cable-pulling compounds.
 - h. Do not exceed a minimum bend radius of 6 times the cable diameter during and after installation.
 - i. Route cables beneath other building infrastructures (i.e. ducts, pipes, conduits, etc.) in above ceiling applications. Do not route cables over building infrastructure/s. The installation shall result in easy accessibility to the cables in the future.
 - j. Place cables 6" minimum away from power sources to reduce interference from EMI.
 - k. Do not set 360-degree service loops in place for slack storage. Instead, set slack as forward-and-back or as figure eights.
 - l. Place a pull string along with cables where run in conduits and spare capacity in conduit remains. Tie off ends of the pull string to prevent the string from falling onto the conduit.
 - m. When exiting the primary pathway, such as cable or basket tray, to the workstation outlets, exit via the top of the pathway. Secure the cables to the pathway using an approved Velcro cable tie.
2. Cable routing and dressing within telecommunications rooms:
- a. Within rooms, only use Velcro type straps on bundles.
 - b. Individual bindles of cable shall not exceed 48 cables to minimize heating of cables that use PoE. Bundles of cables shall be per 48-port patch panel.
 - c. Place cables within the overhead cable support system. When routing vertically on walls, fasten the cables onto vertical supports every 24" on center.
 - d. Provide 12" minimum sheath cable slack, length not to exceed permanent link maximum length requirement. Place the slack in the overhead cable support system.
 - e. At the rack bay, route, and neatly dress cables from the overhead cable support system into the back of the vertical management sections. Divide the cables equally between both sides of an equipment rack such that a cable does not travel past the midpoint of the rack prior to termination. Fasten the cables to the cable support bar at the back of the patch panel using approved ties.
3. Termination in the telecommunications rooms:
- a. Provide termination apparatus and accessories required for a complete installation. Install and assemble termination apparatus, accessories, and associated management apparatus according to the manufacturer's instructions.

- b. Properly relieve strain from the cables to and at termination points per manufacturer's instructions. Provide a strain relief bar at the back of the modular patch panels for proper strain relief.
- c. Terminate cables and twisted pairs in accordance with manufacturer's latest installation requirements and TIA/EIA-568-R standard installation practices. Terminate cable pairs onto the termination apparatus compliant to T568A wiring.
- d. Modular patch panels and horizontal management panels:
 - 1) Provide quantity of patch panels to support the terminations of cables served from respective Telecom Room.
 - 2) Install and assemble patch panels and wire management panels according to the manufacturer's instructions.
 - 3) Install the termination hardware and cable management as shown on the Drawings.
 - 4) Terminate cables in sequential order using the link's identifier starting at the top left and completing a block before moving to the next block below.
 - 5) Terminate all WAP cables on its own patch panel.
- 4. Cable routing and dressing at workstations:
 - a. Provide 18" cable slack at each workstation outlet, length not to exceed permanent link maximum length requirement. Place the slack within ceiling space neatly on a cable hanger or other approved cable support device.
 - b. Route to partition furniture mounted faceplates:
 - 1) Route cables from primary or secondary pathway within ceiling through the furniture partition feed pathway (stub from wall or floor box) into opening at bottom of furniture system. Exercise caution to prevent scraping, cutting or other damage to cable jacket.
 - 2) Provide spiral wrap around cables from furniture-feed pathway to point where cables enter furniture.
- 5. Termination at the workstation outlets:
 - a. Provide device components, connectors, and accessories required for a complete installation. Install and assemble connectors, jacks, adapters, termination apparatus, accessories, and associated management apparatus according to the manufacturer's instructions.
 - b. Provide blue connectors for data links, yellow connectors for wireless data, and green connectors for cameras.
 - c. Wall mounted standard devices:
 - 1) Install devices at heights indicated on drawings.

- 2) Mount faceplates plumb, square and at the same level as adjacent power receptacles.
 - 3) Patch gaps around faceplates so that faceplate covers the entire wall opening.
 - d. Partition furniture mounted devices:
 - 1) Coordinate installation of the faceplate adapters with the furniture contractor, including color.
 - 2) Mount faceplate adapters into the designated openings for horizontal cables.
 - e. Terminate cables and twisted pairs in accordance with the manufacturer's latest installation requirements and TIA/EIA-568-D standard installation practices. Terminate cable pairs onto the connector compliant to T568A wiring.
6. Patching and cross connecting:
- a. In equipment rooms, provide one modular patch cord for each connector jack in each workstation outlet. Install from the horizontal termination field to the network switches/equipment. Neatly dress patch cords within the horizontal and vertical cable management components. Cords lengths shall be coordinated with the Owners IT representative.
 - b. At workstations, provide one modular patch cord for each cable jack installed in each workstation outlet. Cord lengths shall be 10' and each shall be labeled.
- D. General requirements:
1. Labeling, label colors, and identifier assignments shall conform to EIA/EIA-606-C Administration Standards and as approved by the Owner.
 2. Provide permanent and machine-generated labels. Handwritten labels will not be accepted.
- E. Horizontal twisted pair labeling:
1. Labeling shall be per the Owners standards in LIU of the following requirements. Coordinate with the Owners IT representative prior to the labeling phase of the cable installation to determine the Owners labeling requirements.
 2. Cables:
 - a. Text color shall be black, #10 font size.
 - b. Label installation:
 - 1) Provide labels on both ends of cable.
 - 2) Install labels such that they are visible by technician from a normal stance.
 - 3) Fully wrap label around the cable jacket (self-lamination).

- 4) Provide one label within 4" of the termination apparatus.
3. Modular patch panels:
 - a. Text color shall be black, #10 font size.
 - b. Label installation: Provide a Letter designation for each panel (A, B, C etc.). Patch Panel port number will match the cable designation at the station end.
4. Outlets:
 - a. Text color shall be black, #10 font size.
 - b. Label installation:
 - 1) At faceplates, provide labels above and below jacks.
 - 2) At surface boxes, provide labels on the top of the box.

3.3 FIELD QUALITY CONTROL AND TESTING

A. General:

1. Calibrate test sets and associated equipment per the manufacturer's instructions at the beginning of each day's testing and after each battery charge. Fully charge the test sets prior to each day's testing to ensure proper operation.
2. Ensure test equipment and test cords are clean and undamaged during testing activities. Per the Engineer's discretion, halt testing activity and clean testing equipment, test cords and related apparatus.
3. 3. Permanently record test results electronically within test equipment at the time of testing.

B. Twisted pair testing:

1. Test for UTP cabling as follows:

TESTS FOR CATEGORY 6 CABLING TABLE				
Subsystem	Type	Test	Configuration	Notes
Horizontal	Category 6A	Category 6A	Permanent Link	Per TIA/EIA-568-C.2

2. Precautions:
 - a. Adhere to the equipment manufacturer's instructions during all testing.
 - b. Prior to any testing activity or any measurements taken, ensure the test equipment is at room temperature, approximately 70-degrees F.
 - c. Fully charge power sources before each day's testing activity.
3. Horizontal twisted pair testing:
 - a. Test equipment set-up:

- 1) Set-up the tester to perform a full Category 6A test, as a Permanent Link configuration.
- 2) If the tester has the capability, set the cable type as product specific setting. If not, set as generic Category 6A cable.
- 3) Set the tester to save the full test results (all test points, graphs, etc.).
- 4) Save the test results with associated cable link identifier.
- 5) Calibrate the test set per the manufacturer's instructions.

b. Acceptable test results measurements:

- 1) Overall test results:
 - a) Links which report a Fail, Fail or Pass for any of the individual tests shall result in an overall link Fail. All individual test results must result in a Pass to achieve an overall Pass.
 - b) Any reconfiguration of link components required because of a test Fail, must be re-tested for conformance.
 - c) Remove and replace any cabling links failing to meet the criteria described in this Specification, at no cost to the Owner, with cables that prove to meet the minimum requirements.
- 2) Wire map: Provide continuous pairs and terminate all the cabling links correctly at both ends, no exceptions taken.
- 3) Length: One hundred meters (328 feet) is the maximum acceptable electrical length measurements for any cabling link measured under a Permanent Link configuration, including test cords.
- 4) Insertion loss: The acceptable insertion loss measurements for any horizontal cabling link is that which is no greater than that listed in TIA/EIA-568-C.2.
- 5) Worst pair-to-pair near end crosstalk (NEXT) loss: The acceptable worst pair-to-pair NEXT loss for any horizontal cable is that which is no greater than that listed in TIA/EIA-568-C.2.
- 6) Power sum NEXT loss: The acceptable power sum PS-NEXT loss for any horizontal cable is that which is no greater than that listed in TIA/EIA-568-C.2.
- 7) Worst pair-to-pair ELFEXT and FEXT loss: The acceptable worst pair-to-pair ELFEXT and FEXT loss for any horizontal cable is that which is no greater than that listed in TIA/EIA-568-C.2.
- 8) Power sum ELFEXT and FEXT loss: The acceptable PS-ELFEXT and PS-FEXT loss for any horizontal cable is that which is no greater than that listed in TIA/EIA-568-C.2.
- 9) Return loss: The acceptable return loss measurements for any horizontal

cabling link is that which is no greater than that listed in TIA/EIA-568-C.2.

- 10) Propagation delay and delay skew: The acceptable propagation delay and delay skew measurements for any horizontal cabling link is that which is no greater than that listed in TIA/EIA-568-C.2.

C. Record documents:

1. Permanently record all test results.
2. Export test results' numerical values to a single Microsoft Excel spreadsheet.
3. Submit test results in a format acceptable to the Owner, Owner's Representative, and the Engineer before system acceptance.
4. Cable and pair identifiers of the test reports shall match the identifiers as labeled in the field, i.e. use the same ID on the cable/termination label as what appears on the test report.
5. Measurements shall carry a precision through one significant decimal place, minimum.
6. Use feet for the units for measurements shown on the print of the test measurements.
7. Print report such that fiber strands of a given cabling link have matching axis scales. The "X" and the "Y" axis shall be the same from report-to-report.
8. The trace of the printed test report shall show the launch cord.
9. For each cabling link, include either a schematic graphic or a brief narrative accurately describing the test set-up. The description shall include test/launch cord (with length), expected events (connectors, slices, etc.) with expected distances, etc. This information will eliminate many questions the Engineer will have while reviewing the reports.
10. For each twisted pair horizontal cable test, report shall contain the following information:
 - a. Project name and address.
 - b. Test company's and Operator's name.
 - c. Date measurements were taken.
 - d. Test equipment type to include model and serial numbers.
 - e. Cable identification number and pair number.
 - f. Measurement results.
 - g. Pass/Fail

3.4 3.04 INSPECTION AND ADJUSTMENTS

- A. Contractor shall inspect all installed Work in conjunction with the General Contractor and

develop a "punchlist" for all items needing correction. Provide punchlist to the Engineer prior to their final walk of Project.

- B. Punchlist work and the required remediation shall be performed prior to system final acceptance.
- C. Replace or repair work completed by others that was defaced or destroyed during the installation of the telecommunication cabling system by this contractor.
- D. Make changes to adjust the system to optimum operation for final use. Contractor is responsible for making changes to the system such that any defects in workmanship are correct and all cables and the associated termination hardware passes the minimum test requirements.

3.5 CLEANING

- A. Remove all unused, excess, and left-over products, to include debris, spills, and installation equipment.
- B. Leave finished work and adjacent surfaces in neat, clean conditions with no evidence of damage.
- C. Legally dispose of debris.
- D. Clean installed products in accordance with manufacturer's instructions prior to final punch list..

END OF SECTION 27 15 00

**SECTION 27 20 00
STRUCTURED CABLING**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. This document describes the requirements for the contractors, products and installation relating to furnishing and installing a Structured Cabling Plant.
- B. The Cabling System as described in this document is comprised of cabling, infrastructure and termination hardware to provide an approved TIA/EIA Data Networking and Voice Communication Structured Cabling System.
- C. Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Specifying Documentation.
- D. 271000 contractors shall be complete with work including all testing and labeling prior to 272000 contractor work start. Also the district requires minimum of 10 days to review test documents prior to network start up.

1.2 CONTRACTOR QUALIFICATIONS/QUALITY ASSURANCE

- A. Safety and Indemnity
 - 1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 "1.5 A. Safety & Indemnity".
- B. Contractor Qualifications
 - 1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 "1.5 B. Contractor Qualification".
- C. Quality Assurance
 - 1. Contractor shall comply with all requirements as specified in Section 270000 "1.5C Quality Assurance".
- D. Warranty
 - 1. Contractor shall comply with all requirements as specified in Section 270000 "1.8. Acceptance & Warranties".
 - 2. The bid package shall be accompanied by a warranty commitment binding the awarded contractor and manufacturer to a Lifetime Structured Cabling Warranty with guaranteed performance criteria set forth in this document and/or set forth by the Manufacturer. Contractor must be trained and certified in the installation of the Manufacturer system proposed. Contractor shall submit proof of current certification in the Certified Installer Program as a Premier or Authorized Network Installer in order to install and fully warrant the Cabling System. Copy of current Certificate must be included in Proposal if not already on file with Architect/Consultant/Owner.
 - 3. A Lifetime warranty (or 25yr minimum) for the structured cabling system shall be provided for an end-to-end permanent link model installation which covers the performance of the cable, connecting hardware and the labor cost for the repair or replacement of the link.
 - 4. Links failing test parameters or producing marginal pass results will be retested or replaced at Contractor expense until link test results passing TIA/EIA Standard parameters for the category rating or better are achieved.
 - 5. Warranty application is to be submitted in advance of the project start, and full test

reports shall be delivered to Manufacturer within 15 days of project completion.
Lifetime Manufacturer warranty processing is to be completed by Contractor and
warranty certificate delivered to owner upon project completion.

1.3 SUBMITTAL DOCUMENTATION

- A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 270000 "1.6 Submittal Documentation".

1.4 EQUIVALENT PRODUCTS

- A. All Products Leviton, Berk-Tek, Superior Essex, and Chatsworth form the basis of design for this Specification. Part numbers, where provided, exemplify the feature set expected to be provided for this Structured Cabling Plant.
- B. Pre-Approved Equals:
 - 1. **None, all alternate materials must be submitted for approval prior to bid.**
- C. Structured cabling manufacturer system warranties shall be Limited Lifetime or 25year.
- D. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 270000 "1.7 Equivalent Products".

PART 2 PRODUCTS

2.1 WORK AREA SUBSYSTEM

- A. The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:
 - 1. Patch Cords
 - 2. Modular Inserts and Jacks
 - 3. Faceplates
- B. Modular Inserts and Jacks
 - 1. Category 6 Keystone Jack
 - Jacks must exceed the Category 6 standard, and must be Component-Rated for performance.
 - Jacks shall be 8-position 8-conductor RJ45-style and must have "retention- force technology" or equivalent feature to prevent time damage over the life of the jack regardless of use
 - Jacks shall be 8 position un-keyed
 - Jack shall be rear-terminated industry- standard 110 IDC. Lead-frame jacks shall not be used in this Cable Plant.
 - Jacks shall have a designation indicating Category 6 on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code.
 - Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
 - Jacks shall terminate 22-26 AWG stranded or solid conductors.
 - Jacks shall be compatible with single conductor 110 impact termination tools.
 - Jacks shall have an attached color coded wiring instruction label housed between the IDC termination towers.

- Jacks shall be manufactured in the USA
- Jacks shall be compatible with TIA/EIA 606 color code, and have removable high-visibility color labels designating pair locations. Split-colored T568A/B labels are not approved.
- Jacks shall utilize pair-separation towers for ease of untwisting pairs, and shall employ a snap-on rear termination cover designed for suppression and isolate of cross-talk of neighboring connectors.
- Jacks will be terminated according to the T568B wiring scheme.
- Color:
- Data Jacks will be **BLUE**
- Voice Jacks will be **WHITE** Wireless Jacks will be **YELLOW** A/V Jacks will be **GRAY** Camera Jacks will be **PURPLE**
- **Quantity:** Contractor will provide and install one jack for every outlet cable shown on the drawings.
- Part#:
- Data Jacks will be 61110-RL6 Voice Jacks will be 61110-RW6 Wireless Jacks will be 61110-RY6 A/V Jacks will be 61110-RG6 Camera Jacks will be 61110-RP6

C. Wall Mount and Modular Furniture Faceplates

1. Wall Plates

- Faceplates shall be UL Listed and CSA Certified
- Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm)
- Faceplates shall provide for TIA/EIA 606 compliant station labeling.
- Faceplates shall have plastic covers over the mounting screws that can be replaced with a clear plastic window over a printable paper insert.
- Faceplates shall have an industry-standard KEYSTONE opening style, and shall accept any Keystone modular insert.
- Faceplates shall be made in the U.S.A.
- **Color:** Faceplate to be **WHITE**
- **Quantity:** Contractor will provide and install one single gang faceplate for each outlet shown on the drawings.
- Part#:
- 6 Port Face Plate, PN# 42080-6WS
- 4 Port Face Plate, PN# 42080-4WS 2 Port Face Plate, PN# 42080-2WS

2. Blank Insert

- **Color:** Blank Insert to match device plate or raceway.
- **Quantity:** Contractor will provide and install one insert for every unused port in a faceplate.
- Part#: 41084-B*B (*=W for **WHITE**, I for **IVORY**)

3. Blank Wall Plates

- Faceplate shall be constructed from stainless steel.
- Faceplates shall be UL Listed and CSA Certified
- Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm) for single gang.
- Color: Faceplate to be STAINLESS STEEL
- **Quantity:** Contractor will provide and install one faceplate for each unused data/voice/video/intercom outlet shown on the drawings.
- **Part#:** 84014-40

4. Surface Mount Raceway Insert

Inserts for Wiremold's 4050, 5450 and 5550 Device Mounting Brackets

- Insert shall allow for two category 6 jacks to be mounted flush.
- Insert shall match the color of the Raceway installed.
- Color: Faceplate to be IVORY
- Quantity: Contractor will provide and install one 2-port insert for each outlet in the Surface Mount Raceway shown on the drawings.
- Part#: Equal to Wiremold, PN# 5507FRJ

2.2 HORIZONTAL DISTRIBUTION CABLING

The horizontal distribution cabling system is the portion of the telecommunications cabling system that extends from the Work Area (WA) telecommunications outlet/connector to the horizontal cross-connect in the Telecommunications Room (TR).

- CABLING SUPPORT SYSTEM
- COPPER STATION CABLING
- COPPER CROSS-CONNECT CABLING

A. Copper Station Cable

1. Category 6 Unshielded Twisted Pair (UTP) Cable

- Cable will meet or exceed the proposed requirements of ANSI/TIA/EIA 568- C.2, 568-B.2 Addendum #1 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, and Delay Skew.
- Cable shall be proven to support Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP- PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.
- The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
- All cable shall conform to the requirements for communications circuits defined by the California Electrical Code (Article 800) and the Canadian Building Code. Cable listed to CEC Article 800-51(a) will be used for "Plenum" installations. Cable listed to CEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.
- Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
- Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
- Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
- Cables shall be made in the U.S.A.
- The listed Category 6 cables in this specification are manufactured by Berk-Tek unless otherwise noted.
- Color:
- Data cable jacket will be BLUE
- Data cable for Security Cameras will be PURPLE
- Quantity: See Drawing for quantity and installation details.
- Part#:
- For Riser Application:
- Berk-Tek PN# 10136339
- For Plenum Application:
- Berk-Tek PN# 10136226

- For Indoor/Outdoor Application:
- Mohawk **CDT PN# M58772 (all cable jackets will be BLACK)**

B. Horizontal Copper Cross-Connect Cabling

1. Voice Cross-Connect Cabling

- Cable shall meet and/or exceed the UL Listed Type CMR and the ANSI/ICEA S-80-576 standard.
- Cables shall be made in the U.S.A.
- Core Construction
- Conductors: Solid-copper conductors, 24 AWG.
- Insulation: Flame retardant semi-rigid PVC.
- Core Assembly: Cable core will be made up of 100 pair units consisting of four (4) 25 pair sub-units. Each group individually identifiable by color coded unit binders.
- Jacket: Gray, flame retardant PVC jacket.
- Color: Voice cable jacket will be GRAY
- Quantity: See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs required for the cross-connect by 1.25 to the nearest 25-pair increment.
- Part#:
- Superior Essex Cable: Berk-Tek:
- 25 pair = PN# 18-475-33 10032396
- 50 pair = PN# 18-579-33 10032471
- 100 pair = PN# 18-789-33 10032472

2.3 BACKBONE CABLING

The backbone cabling system is the portion of the telecommunications cabling system that extends from the Intermediate Distribution Frame (IDF) to the Main Distribution Frame (MDF).

A. Fiber Optic Backbone Cabling - Singlemode

1. Cable Construction:
 - Tight Buffered
 - Dry water-blocking tape.
 - Epoxy glass central strength member.
2. Jacket Material: Flame retardant UV stabilized , OFNP rated
3. Fiber Count: As indicated on Drawings (single mode/multimode).
4. Fiber Type:
 - Single-mode: 8.2/125.
 - Color coded 250 micron fibers.
5. Color Code: TIA/EIA-598-A, Optical Fiber Cable Color Coding.
6. Maximum Pulling Tension:
 - Up to 12 strand: 1335 N (300 lb/f) during installation, 400 N (90 lb/f) installed
 - 18 strand and above: 2670 N (600 lb/f) during installation, 801 N (180 lb/f) installed
7. Storage Temperature: -40 to +70 degrees C (-40 to +158 degrees F).
8. Installation Temperature: 0 to +60 degrees C (+32 to +140 degrees F).
9. Operating Temperature: -40 to +70 degrees C (-40 to +158 degrees F).
10. Cable shall be UL/cUL OFNP/OFN FTA (Plenum) rated and be Flame Resistant in accordance with the UL 1666.
11. Cable shall be constructed utilizing a loose tube design.

12. Cable will maintain the following:
 - Crush Resistance (EIA-455-41) = 2000 N/cm
 - Impact Resistance (EIA-455-25) = 2000 Impacts w/1.6 N-m
 - Min Bend Radius, Long Term - No Load = 15x Cable diameter; Short Term – Load = 20x Cable diameter
 13. The Fiber Optic Cable in this specification is manufactured by Berk-Tek
 14. Singlemode Fiber cables shall be pre-terminated in 12-strand MTP connectors, with factory-attached pulling head. Cables shall not be pulled through flooded or muddy conduits. Mandrel all conduits prior to pulling.
 15. **Color:** Fiber Optic cable jacket will be **Aqua**
 16. **Quantity:** See Drawing for quantity and installation details.
- B. Fiber Optic Backbone Cabling - Multimode
1. Cable Construction:
 - Tight Buffered
 - Dry water-blocking tape.
 - Epoxy glass central strength member.
 2. Jacket Material: Flame retardant UV stabilized , OFNP rated
 3. Fiber Count: As indicated on Drawings (single mode/multimode).
 4. Fiber Type:
 - Single-mode: 8.2/125.
 - Multimode: 50/125 Laser-Optimized OM3 capable of 1 Gigabit Ethernet Link at 1000m/600m (@850nm/1300nm) 10 Gigabit Ethernet Link at 300m/300m (@850nm/1300nm)
 5. Color coded 250 micron fibers.
 6. Color Code: TIA/EIA-598-A, Optical Fiber Cable Color Coding.
 - Maximum Pulling Tension:
 - Up to 12 strand: 1335 N (300 lb/f) during installation, 400 N (90 lb/f) installed
 - 18 strand and above: 2670 N (600 lb/f) during installation, 801 N (180 lb/f) installed
 7. Storage Temperature: -40 to +70 degrees C (-40 to +158 degrees F).
 8. Installation Temperature: 0 to +60 degrees C (+32 to +140 degrees F).
 9. Operating Temperature: -40 to +70 degrees C (-40 to +158 degrees F).
 10. Cable shall be UL/cUL OFNR/OFN FTA (Riser) or OFNP (Plenum) rated and be Flame Resistant in accordance with the UL 1666.
 11. Cable shall be constructed utilizing a loose tube design.
 12. Cable will maintain the following:
 - Crush Resistance (EIA-455-41) = 2000 N/cm
 - Impact Resistance (EIA-455-25) = 2000 Impacts w/1.6 N-m
 - Min Bend Radius, Long Term - No Load = 15x Cable diameter; Short Term – Load = 20x Cable diameter
 13. The Fiber Optic Cable in this specification is manufactured by Berk-Tek
 14. Color: Fiber Optic cable jacket will be Aqua
 15. Quantity: See Drawing for quantity and installation details.
- C. Fiber Optic Terminations – Trunk Cabling
1. Optical fiber cable trunks shall have a breakout of 3 feet. All fiber trunks shall utilize a heat shrink at the ends of all breakouts to create a smooth breakout of the fiber subunit legs
 2. All Singlemode optical fiber cables shall utilize the 12-strand MTP connector. 24-strand cables shall have (2) 12-strand Singlemode MTP cables factory terminated at both ends.
 3. All Multimode optical fiber cables shall utilize the 24-strand MTP connector.
 4. Optical fiber trunks shall utilize female MTP connectors. Pinned and generic-style MPO connectors are not acceptable quality.
 5. All Fiber Optic Trunks shall utilize Method B Polarity.

6. All optical fiber cabling trunks shall have a unique identifying label with a bar code for quick identification. The label shall state Manufacturer, trunk length and serial number.
7. A pulling eye shall be installed on all trunks to help facilitate installation of the trunk. Trunks over 125' shall be provided on wooden reels.
8. The contractor shall be responsible for the correct fiber trunk lengths, configuration, and ordering. Fiber Trunk part numbers shall be generated at www.Leviton.com/Configurator (Online) and must be verified by Manufacturer prior to ordering..

Approved Products:

Leviton Unity Part # FT-EB024JJ100F38C38CY-YYBS (sample part #, actual part # TDB as required)

Where:

FT	Fiber trunk
E	OM3 (use A for OS2 Singlemode)
B	Dry loose tube OFNP Plenum (use A for OFNR)
024	24-strand
JJ	Female 24-strand MTP on each end (use LL for 12-strand MTP breakout)
100F	100' (use 3-digit length and M for meters)
38	38" breakout
C	3mm jacketed fiber breakout leg
38C	same
Y	Pulling eye Yes (or N)
YY	staggered ends, 1st and 2nd end both (NN, YN, NY options)
B	Method B polarity
S	Standard labeling

D. Copper System Backbone Cabling

1. Voice System Backbone Cabling

Cable shall meet or exceed those specified in RUS Bulletin 1753F-208 (REA PE-89)

Cables shall be made in the U.S.A.

Core Construction

Conductors: Solid, annealed copper, 24 AWG unless otherwise noted on design documents.

Insulation: Dual insulation consisting of an inner layer of foamed polyolefin skin, colored coded in accordance with industry standards

Core Assembly: Cables of 25 pairs and less formed by assembling pairs together in a single group. Cables of more than 25 pairs formed by twisted pairs arranged in groups with each group having a color coded unit binder.

Filling Compound: The entire core assembly completely filled with ETPR compound, filling the interstices between the pairs and under the core tape.

Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.

Sheath Construction

Aluminum Shield: Corrosion protected plastic coated, corrugated 0.008" aluminum tape.

Jacket: Black, linear low-density polyethylene.

Color: Voice cable jacket will be BLACK

Quantity: See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the

number of pairs serving the individual telephone handsets by 1.25 to the nearest 25-pair increment.

Part#: Equal to Superior Essex Cable: 25 pair = PN# 09-097-02

50 pair = PN# 09-100-02

100 pair = PN# 09-104-02

200 pair = PN# 09-108-02

2.4 TELECOMMUNICATION ROOM

The Telecommunication Room (TR) includes those products that terminate horizontal and backbone cabling subsystems and connect them to the network equipment.

- Patch Cords
- Horizontal Cabling Termination Equipment
- Backbone Cabling Termination Equipment
- Cabinets, Racks, and Enclosures
- Cable Support System

A. Patch Cords

1. Copper patch cords for CAT6 UTP user locations shall exhibit the following characteristics:
 - 26-gauge, unshielded, twisted pair, stranded conductor construction with a standard 8-position modular plug on both ends.
 - Plug contacts shall be plated with minimum of 50 micro-inches (μm) of gold
 - Slimline, integrated snag-less molded plug design with integrated strain relief, without incorporating the use of any secondary or 2-piece rubber over-boot.
 - Maximum Outer Diameter of 0.24"
 - Power over Ethernet (PoE and PoE+) compatible
 - Support 1 Gigabit applications over 90-meter permanent links with up to 10 meters of cordage
 - Meets all applicable standards and listings: ANSI/TIA-1096-A (formerly FCC Part 68), RoHS compliant, IEEE 802.3, PoE: IEEE 802.3at – 2012
 - Color: White
 - Provide 1 patch cord (length TBD) for each jack/outlet installed under this Specification.
 - Part #: Leviton Slimline CAT6 Component-rated Patch Cord, White, # 6D460-xxW (where xx = Length, in Feet)
2. Fiber Patch Cords
 - Fiber optic LC-LC patch cords, or jumpers, will make LC connections from the rack termination points to the equipment. The jumpers will meet the following requirements:
 - Factory-manufactured using Singlemode OS2 or Multimode OM3 optical fiber. Field terminations on fiber jumpers are not acceptable.
 - Shall utilize A-B polarity.
 - Shall exhibit <0.3 dB insertion loss and -25 dB return loss.
 - Shall be available in standard lengths of 1, 2, 3, 5 and 10 meters and custom-orderable up to any length of feet or meters
 - Provide factory assembled patch cords meeting or exceeding all criteria specified in the horizontal cabling standard subsection above, in the following quantities and/or as specified in Part 3:
 - (2) 2m LC duplex fiber jumper for each duplex port, or 1 patch cord per strand terminated in MDF.
 - Verify lengths, quantities and configuration with owner prior to delivery.
 - Part #: Leviton LC-LC SM duplex jumper, UPDLC-Sxx; LC-LC Multimode jumper,

5LDLC-Mxx (where xx = Length in Meters)

B. Horizontal Cable Termination Equipment

1. Copper Termination Equipment

- Data Category 6 Patch Panels
 - Panels shall be made of black 16-gauge steel in 24 port configurations.
 - Panels shall have optional rear cable support bar for strain relief. Cable support bar shall attach to the rear of the patch panel itself without the use of additional fasteners or screws.
 - Panels shall have write-on blocks and port numbers are silk-screened in white.
 - Panels shall provide wiring identification & color code and maintain an in-line, paired punch down sequence that does not require the splitting of conductors from individual cable pairs.
 - The panel shall accept all QuickPort modules and feature white write-on front labels.
 - Panels shall be ANSI/TIA/EIA-568-C.1, C.2 and ISO/IEC 11801 category 6 compliant.
 - Panels shall be UL LISTED 1863 and CSA certified.
 - Panels shall be made by an ISO 9002 Certified Manufacturer.
 - Panels shall be made in the U.S.A.
 - Color: Patch Panel shall be BLACK
 - Quantity: See Drawing for quantity and installation details. The number of patch panels to be supplied shall be derived by multiplying the number of data/voice cables being terminated at the individual TR by 1.25 and providing additional panels in the nearest 24 port increment.
 - Part#:
 - Leviton 24-port Category 6 patch panel, angled recessed, 4W256-H24
- Voice Termination Block (Intercom Backbone and Intercom Devices)
 - Pair Capacity 50
 - Blocks shall be wall mounted.
 - Terminates 22 - 26 AWG (0.81 - 0.41mm) solid insulated cable or 18 - 19 AWG (1.02 - 0.91mm) solid stripped cable
 - Blocks shall have stand-off legs included for all locations; S89 series stand-off bracket
 - Made from High impact flame retardant thermoplastic
 - Height: 254mm (10 in.), width: 86.4mm (3.4 in.), depth: 30.5mm (1.2 in.)
 - Part#: Leviton or equal Termination block, 40066-M50 Mounting bracket, 40089-00D

C. Backbone Cable Termination Equipment

1. Connectors

Fiber Optic Connectors

- 1) Anaerobic & Mechanical terminations will not be accepted.

2. MTP MODULES

Fiber optic MTP-MTP configured trunks will land on a 24-strand (12 LC Duplex Port) MTP-LC Cassette module. The modules shall meet the following requirements:

- Insertable directly into fiber enclosure panel openings with a color-indicating push-on lockpin latch.
 - Rated for Laser Optimized Multi-mode OM4 optical fiber.
 - Shall utilize a male MTP connection.
 - Shall utilize Method B Polarity.
 - Shall require one Core module at one end of a fiber trunk segment, and one Edge module at the second end to maintain correct polarity across the system.
 - Core modules should be placed at the HDA, and Edge modules at the MDA and EDA for consistency of design.
 - Part#: Leviton FM-E024CDC0BC Core module, FM-F024CDC0BE Edge module (denotes Method B polarity, 24-fiber MTP, OM3)
3. Fusion-Fiber Pigtail Fusion Splice Module
- To be utilized only as approved in writing by Owner or Owner's representative, based on field conditions.
 - Integrated module adapter bulkhead for 12 or 24 fibers with self-contained splice holders
 - Individual compartments provide slack storage and bend radius guides for respective backbone cable, 900µm tight buffer pigtails, and fusion spliced fibers
 - 12-fiber color-coded 900µm tight buffer pigtails 1.5m length are pre-loaded in module per specific configuration
 - Modular design allows for ease of maintenance of individual spliced fiber and allows for scaling up without impacting existing fibers
 - Included accessory kit consists of heat shrink style splice sleeves, tie wraps, and mesh sleeve
 - Installs in Leviton's Opt-X rack mount (Ultra, 1000i, and 500i) and wall mount fiber enclosures
 - Zirconia ceramic ferrules and sleeves used
 - 12-fiber splice module configurations will utilize duplex LC adapters
 - 24-fiber splice module configurations will utilize quad LC adapters
 - ALL FIBER SHALL BE FUSION SPLICED
 - Quantity: See Drawing for quantity and installation details.
 - Part #: Leviton or equal
 - 12-strand Singlemode, SPLCS-12L
 - 24-strand Singlemode, SPLCS-24L
 - 12-strand Singlemode Fusion Splice pigtail kit, UPPLC-KIT
4. Fiber Termination Panels
- IDF Rack Mount Fiber Panel
- Fiber panels shall be constructed of durable polycarbonate plastic and black powder-coated 16-gauge steel
 - Panel shall have a sliding tray which removes completely from enclosure to facilitate field terminations and splicing
 - Sliding tray with front and rear stop shall glide forward and backward providing accessibility to front and rear of bulkhead after installation
 - Panel shall have a 17" depth for high-density fiber termination and/or splicing
 - Front saddles shall pivot for improved patch cord routing and organization
 - Removable transparent hinged doors and slide-away covers shall allow for easy access during install and visibility of interior after install
 - Panel shall employ patch cord bend radius guides to minimize macro bending
 - Stackable and adjustable fiber rings simplify cable management
 - Panel shall be no more than 1 rack unit in height and shall hold up to 3

adapter plates.

- Panel shall be Made in the U.S.A
- COLOR: black with translucent blue cover panels
- Quantity: See Drawing for quantity and installation details.
- Part#: Leviton Opt-X Ultra no exceptions
- 1U - 5R1UH-S03

IDF Wall Mount Fiber Panel

- Panels shall be constructed of cold rolled 16 gauge steel with a black powder paint finish and provide for fully enclosed fiber termination.
- Panel shall have a door design. One door shall be lockable for the "technician side" that secures the incoming and outgoing fiber cables. The second door shall accessible to provide fiber patching as needed.
- Panels shall accept four adapter panels for 24 port configurations.
- Panels shall have a splice tray mounting stud incorporated into the base for mounting of mechanical or fusion splice trays. Panel shall have cable management anchor points and come with cable anchors allowing for the maintenance of the incoming cable with the proper minimum bend radius.
- Panels shall have cable entrance ports on the top and bottom with removable plastic dust covers.
- Color: Fiber Panel will be BLACK
- Quantity: See Drawing for quantity and installation details.
- Part: 5W320-00N

MDF Rack Mount Fiber Panel

- Fiber panels shall be constructed of durable polycarbonate plastic and black powder-coated 16-gauge steel
- Panel shall have a sliding tray which removes completely from enclosure to facilitate field terminations and splicing
- Sliding tray with front and rear stop shall glide forward and backward providing accessibility to front and rear of bulkhead after installation
- Panel shall have a 17" depth for high-density fiber termination and/or splicing
- Front saddles shall pivot for improved patch cord routing and organization
- Removable transparent hinged doors and slide-away covers shall allow for easy access during install and visibility of interior after install
- Panel shall employ patch cord bend radius guides to minimize macro bending
- Stackable and adjustable fiber rings simplify cable management
- Panel shall be 2 or 4 rack units in height and shall hold up to 6 or 12 adapter plates, respectively
- Panel shall be Made in the United States
- COLOR: black with translucent blue cover panels
- Quantity: See Drawing for quantity and installation details.
- Part#: Leviton Opt-X Ultra no exceptions
- 2U - 5R2UH-S06
- 4U - 5R4UH-S12

Premise Splice Enclosures – Portable Classroom Distribution

- Modular wall-mount enclosures used to directly splice outside plant or intra-building cables
- Four fusion/mechanical splice trays; 4" Standard Splice Tray, 4" x 11.75" x 0.25" # T4LHS-P06
- Constructed of cold-rolled steel
- ALL FIBER SHALL BE FUSION SPLICED
- CPS-24, Customer Premise Splice Enclosure, empty (2 tray capacity)
- Part#: CPS24-STD

- Fiber Optic OSP Splice Enclosures
- Used to directly splice outside plant or intra-building cables.
 - Accommodates various splice tray designs, Maximum Capacity: 96 single fibers using 5" x 7" and 4" x 7" trays
 - Enclosure made from 16-gauge steel, Hinges shall be Stainless steel
 - Two-year limited product warranty.
 - Durable powder-coat finish COLOR: Beige
 - Size 16" x 15" x 3.4"
 - ALL FIBER SHALL BE FUSION SPLICED
 - Part #: Leviton CPS Customer Premise Splice Enclosure, Single Door, 24 Fiber Trays # CPS24-STD
 - Injection Molded Mini Splice Tray, Heat Shrink style (accepts standard sleeves), up to 12 fiber splicing # T5PLS-12F
 - Splice Tray Mounting Hardware Kit # SPLMT-HKT
 - Splice Sleeve, 40 mm # FSSSD-040
 - Cable clamp kit # CPCSR-001 & CPCSR-002 Grounding kit # CPGRD-KIT
 - Key Locking kit # CPLOK-KIT
5. Copper Termination Panels
- OSP Protection Panels (Intercom Backbone Headend)
- 16 AWG POWDER COATED STEEL CONSTRUCTION
 - EQUIPPED WITH AN INTERNAL 26 AWG FUSE LINK
 - EXTERNAL GROUND CONNECTORS ACCEPT 6 - 14 AWG WIRE
 - INDUSTRY STANDARD 5 PIN DESIGN
 - EXCEEDS UL497 PRIMARY PROTECTION STANDARDS
 - STACKABLE WITH CONNECTION GROMMETS INCLUDED
 - 66 BLOCK ACCEPTS 22 - 26 AWG WIRE/18 - 19 AWG STRIPPED SOLID COPPER WIRE
 - COLOR: NA
 - QUANTITY: SEE DRAWING FOR QUANTITY AND INSTALLATION DETAILS.
 - PART#: CIRCA ENTERPRISE INC.
 - 25 PAIR BLOCK, PN# 1890ECT1-25 50 PAIR BLOCK, PN# 1890ECT1-50 100 PAIR BLOCK, PN# 1890ECT1-100
- OSP Protection Modules
- 240VDC (RUS Approved)
 - Nanosecond response time
 - External failsafe mechanism that permanently carbon arrestors grounds the module under sustained high current conditions
 - Integrated Test Points
 - UL & cUL listed
 - Designed to meet or exceed Telcordia standards
 - ISO 9002 Certified Manufacturer
 - Color: RED
 - Quantity: See Drawing for quantity and installation details.
 - Part#: Circa Enterprise inc. 4B1SF-240
 - *Provide 100% fuse density for all installed Protection Panels.
- Voice Termination Block (Intercom Backbone building/TC and Intercom Devices)
- Pair Capacity 50
 - Blocks shall be wall mounted.
 - Terminates 22 - 26 AWG (0.81 - 0.41mm) solid insulated cable or 18 - 19 AWG (1.02 - 0.91mm) solid stripped cable
 - Blocks shall have stand-off legs included for all locations; S89 series stand-off bracket

- Made from High impact flame retardant thermoplastic
- Height: 254mm (10 in.), width: 86.4mm (3.4 in.), depth: 30.5mm (1.2 in.)
- Part#:
- Leviton Termination block, 40066-M50
- Mounting bracket, 40089-00D

D. CABINETS, RACKS, AND ENCLOSURES

Contractor will provide the following 'IDF' Enclosures and components based on the number of cables to that will be terminated:

1. Remote Equipment Cabinet

- Remote equipment cabinets shall be manufactured from steel. Each cabinet shall have a rectangular body with a removable top panel and a hinged, locking front door. The door shall be solid (no window) and shall be reversible to open from the right or left side. Each cabinet shall include two keys for the door.
- The cabinet shall be constructed to meet the requirements of a NEMA Type 2 Enclosure.
- The cabinet shall include a minimum of two pairs of 19" wide EIA-310-D compliant equipment mounting rails that can be mounted to the cabinet to align equipment with the top or front of the cabinet or at a 45° angle to the back of the cabinet. The mounting rails shall support 2, 4 or 6 RMU of equipment. The cabinet shall provide space for equipment up to 20" deep when aligned with the top of the cabinet or 4" (100 mm) deep when aligned with the front of the cabinet.
- The sides and bottom of the cabinet shall be pre-punched with combination 3/4" and 1-1/2" conduit knockouts for network cable access. The rear of the cabinet shall have a 4" x 6" opening located near the bottom center of the cabinet for through-the-wall network cable access. Cable tie points shall be located around the interior perimeter on the cabinet's rear panel.
- The sides of the cabinet shall have louvers to permit airflow into and through the cabinet. The bottom of the cabinet shall have a grill to allow the addition of an accessory ventilation fan.
- Rack shall provide for a grounding point per the TIA/EIA 607-A.
- The cabinet shall support 100 lb of equipment. Load bearing capacity shall be stated in the manufacturer's product literature.
- Color: Remote Equipment Cabinet will be BLACK
- Finish shall be black epoxy-polyester hybrid powder coat paint.
- Mounting rails are anodized aluminum.
- Quantity: See Drawing for quantity and installation details.
- Part#:
- Remote Equipment Cabinet
- Equal to CPI PN# 13050-723, ThinLine II Wall-Mount Cabinet, 26" Wide x 36" High x 12" Deep Exterior, 19" EIA x 6 RMU.
- Fiber Optic Bracket
- Equal to CPI PN# 12955-719
- Fan Kit
- Equal to CPI PN# 13051-001
- 15amp Power Kit
- Equal to CPI PN# 12934-001
- 12-24 Rack Screws (bag of 50) Equal to CPI PN# 40605-005
- Power Strip with Surge Suppression Leviton 5500-192

2. Wall-mounted cabinets

- Wall-mounted cabinets shall be manufactured from steel sheet.
- Each cabinet will have a rear panel that attaches to the wall, a hinged cabinet body that swings open from the rear panel providing easy access to the rear of equipment and a locking front door.
- The rear panel will provide cable access with pre-punched knockouts, up to 3", for conduit along the top and bottom edges of the panel. There will also be cutouts in the back of the rear panel so that cables can enter the panel through the wall. The rear panel will provide attachment points for accessory equipment mounting brackets and cable tie points within the panel (cabinet).
- The cabinet body will include a single pair of vertical 19" EIA equipment mounting rails. The mounting rails will be EIA-310-D compliant with the Universal hole pattern. Mounting holes will have #12-24 threads.
- Mounting rails will be adjustable in depth so that they can be positioned at any point within the cabinet body. The design of all cabinets will allow an additional pair of mounting rails (for a total of two pairs of mounting rails per cabinet) to be added to the cabinet.
- The wall-mount cabinet shall provide a hinge design that attaches the cabinet body and the rear panel and allow the rear panel to be removed during installation. The hinge design will allow the cabinet body to open at least 90°. The hasp used to secure the rear panel and the cabinet body together will assist in drawing the components together during the locking action.
- The cabinet body will include vents that are designed to accept fan kits.
- The front door will be hinged and locking. The front door and rear panel will be keyed alike. The front door will have rounded edges and corners. The cabinet body will allow the front door to be attached so that it will swing open from the right or left. The cabinet manufacture shall provide an option for a solid or a tinted plexi-glass window front door. The plexi-glass in doors shall be bronze acrylic (not clear) with a UL flammability classification of 94HB or better.
- Finish shall be epoxy-polyester hybrid powder coat (paint).
- The cabinet shall have the option of being delivered fully assembled. All cabinets will include installation hardware (hex lag screws) for wood studs and 50 each #12-24 equipment mounting screws.
- Load bearing capacity for cabinets that wall-mount will be a minimum of 200 pounds per cabinet.
- Cabinets that are wall-mount only will be certified and UL Listed to standard UL 60950 under category NWIN.
- CONTRACTOR TO INSTALL PROFESSIONALLY SO OWNER PROVIDED EQUIPMENT FITS IN THE RACK. VERIFY RAILS ARE PROPERLY ALIGNED SO ALL EQUIPMENT FITS (including cables/cords) AND DOORS CLOSE. VERIFY SPACING BETWEEN PANELS IS ADEQUATE FOR EQUIPMENT INSTALLATION.
- Color: Wall Mount Cabinet will be BLACK
- Quantity: See Drawing for size, quantity and installation details.
- Part#:
- Wall Mount Cabinet
- 12U Cabinet equal to Chatsworth Products, PN# 11900-724 18U Cabinet equal to Chatsworth Products, PN# 11900-736 26U Cabinet equal to Chatsworth Products, PN# 11900-748
- *Contractor will provide an additional set of mounting rails for each wall mount cabinet, equal to Chatsworth Products PN# 12787-5xx.

- Wall/Floor Mount Cabinet
- 33U Cabinet equal to Chatsworth Products, PN# 13495-760 40U Cabinet equal to Chatsworth Products, PN# 13495-772
- *Contractor will provide an additional set of mounting rails for each wall mount cabinet, equal to Chatsworth Products PN# 13276-7xx.
- Fan Kit/Filter Kit
- Equal to Chatsworth Products Fan Kit, PN# 12804-701 Equal to Chatsworth Products Filter Kit, PN# 12805-701 Grounding Kit
- Equal to Chatsworth Products, PN# 10610-019 Power Strip with Surge Suppression
- Leviton 5500-192

3. Floor Mount 2-post Racks

- Each rack shall have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack shall assemble with nut and bolt hardware. The base angles shall be pre-punched for attachment to the floor.
- Equipment mounting channels shall be 3" (76 mm) deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern, 1-3/4" (44.45 mm) rack-mount spaces (U), to provide 45U, 52U or 58U for equipment. Each mounting space (U) shall be marked and numbered on the mounting channel.
- When assembled with top and bottom angles, equipment-mounting channels shall be spaced to allow attachment of 19" EIA rack-mount equipment. Equipment attachment points shall be threaded with 12-24 roll-formed threads. The rack shall include assembly and equipment-mounting hardware. Racks shall include 50 each combination pan head, pilot point mounting screws.
- The assembled rack shall measure 7' (2.1 m)/84" (2133 mm) high, 8' (2.4 m)/96" (2438 mm) high or 9' (2.7 m)/108" (2743 mm) high; 20.3" (515.9 mm) wide and 15" (381.0 mm) deep. The sides (webs) of the equipment-mounting channels shall be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
- Assembly hardware shall electrically bond the top angles, side channels and base angles together when assembled, and there shall be a masked ground attachment point with 1/4-20 threaded studs spaced 5/8" apart on the inside of the side channel to attach a ground lug allowing easy attachment to the Telecommunications Ground.
- The rack shall be rated for 1,000 lb (453.6 kg) of equipment.
- Certifications: Communications Circuit Accessory, DUXR and DUXR7 category, file number 140851
- Material: Steel and aluminum extrusion
- Construction: Bolted assembly, Ships unassembled
- Color: BLACK
- Quantity: See Drawing for quantity and installation details.
- Part#: Chatsworth Products Inc.
- Floor Mount 2-Post Rack CPI# 55053-703
- Vertical Wire Managers
- Equal to Leviton, PN# 8980L-VFR Power Strip with Surge Suppression Leviton 5500-192

4. Floor Mount 4-post Racks

- Four-post frame with threaded mounting holes used to support 19" wide rack-mount communications equipment and shelves
- For indoor use only, in environmentally controlled areas; may not be used

- outdoors, in industrial or harsh environments, or in plenum spaces
- Includes: (1) top pan, (1) bottom pan, (4) mounting channels, (2) base angles, (2) top angles
- Assembly hardware; (100) #12-24 equipment mounting screws
- Equipment Support: Front and rear pairs of 3" deep C-shaped equipment mounting channels, Fixed in place, 29" apart front-to-rear, 19" wide, EIA-310- D compliant hole pattern
- 1-3/4" high rack-mount units (RMU); RMU spaces are marked and numbered on the channels
- Universal hole pattern, 5/8"-5/8"-1/2" vertical hole spacing
- Threaded #12-24 equipment mounting holes, Includes 100 each #12-24 equipment mounting screws
- Load capacity: 2000 lb of equipment
- Material: Aluminum extrusion, Aluminum sheet
- Construction: Bolted assembly, Ships unassembled
- Color: BLACK
- Quantity: See Drawing for quantity and installation details.
- Part#: Chatsworth Products Inc. Floor Mount 4-Post Open Frame Rack CPI# 15053-703
- Grounding Kit 10610-019
- Power Strip with Surge Suppression Leviton 5500-192

5. Floor Mount Cabinets

- Four-post frame with threaded mounting holes used to support 19" wide rack-mount communications equipment and shelves
- For indoor use only, in environmentally controlled areas; may not be used outdoors, in industrial or harsh environments, or in plenum spaces
- Includes: (1) top pan, (1) bottom pan, (4) mounting channels, (2) base angles, (2) top angles
- Assembly hardware; (100) #12-24 equipment mounting screws
- Equipment Support: Front and rear pairs of 3" deep C-shaped equipment mounting channels, Fixed in place, 29" apart front-to-rear, 19" wide, EIA-310- D compliant hole pattern
- 1-3/4" high rack-mount units (RMU); RMU spaces are marked and numbered on the channels
- Universal hole pattern, 5/8"-5/8"-1/2" vertical hole spacing
- Threaded #12-24 equipment mounting holes, Includes 100 each #12-24 equipment mounting screws
- Load capacity: 2000 lb of equipment
- Material: Aluminum extrusion, Aluminum sheet
- Construction: Bolted assembly, Ships unassembled
- Color: BLACK
- Quantity: See Drawing for quantity and installation details.
- Part#: Chatsworth Products Inc.
- Floor Mount Cabinet CPI# M1050-741
- Grounding Kit 10610-019
- Power Strip with Surge Suppression Leviton 5500-192

6. Outdoor Wireless Access Point Enclosure

- Non-glass-filled polyester material, UV

- resistance; Overlapping tongue-and-groove raised cover and gasket provide secure Type 4X seal
- Removable snap-hinge cover allows for easy access to cover and body for modifications
- Molded layout grid on inside of body and solid covers assists with component mounting
- Molded-in embosses for rear panel mounting
- Internal rail system and adjustable panel blocks allow
- UL 508A Listed, NEMA/EEMAC Type 4
- Material: Non-glass-filled polyester
- Color: Light-Gray
- Quantity: See Drawing for quantity and installation details.
- Part#: Pentair
- Polypro Wifi, PN# D16148WF

E. Cable Support System

1. Ladder Rack Cable Runway

- Stringers shall be fabricated from 16ga .375" x 1.5" Cold Rolled Steel tubing.
- Rungs shall be fabricated from 16ga .5" x 1.0" Cold Rolled Steel tubing
- Rungs shall be spaced at 9.0" center to center
- A straight length of ladder shall be capable of supporting 45 pounds per foot when a 10' length is tested according to NEMA VE-1.
- Ladder Rack shall have a powder coat finished.
- Ladder Rack shall be available in standard 6ft. and 10ft. lengths.
- Ladder rack shall be a part of a total system that includes: manufacture bends, wall supports, joining hardware, etc.
- Ladder Rack shall be grounding per the TIA/EIA 607-A.
- Color: Ladder Rack will be BLACK
- Quantity: See Drawing for quantity and installation details.
- Part#: Equal to Chatsworth Products Cable Raceway, PN# 11252-71X

2. Backbone Slack Loops

- Storage rings may be used to store coiled slack loops on backboard.
- Part #:
- Fiber storage rings, Indoor fiber: 48900-IFR Fiber storage rings, Outdoor fiber: 48900-OFR

PART 3 PART 3 – EXECUTION

3.1 INSTALLATION

A. Work Area Outlets Installation

- No more than 12" of cable shall be stored in an outlet box, modular furniture raceway, or insulated walls.
- Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
- The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
- All UTP cables shall have no more than 6.4mm (1/4 inch) of pair *untwisted* at the termination point.
- Data jacks, unless otherwise noted in drawings, shall be located in the top

position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).

- Voice jacks, unless otherwise noted in drawings, shall occupy the next position(s) below the data on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the position left of the data jack.
- Video jacks, unless otherwise noted in drawings, shall occupy the bottom position(s) on the faceplate. Video jacks in horizontally oriented faceplates shall occupy the position left of the data/voice jack.
- All faceplates installed shall be level.
- All outlets will be labeled according to the approved labeling scheme.
- Each faceplate shall be machine labeled. The labeling shall be placed on the faceplate so that the individual jack can be clearly identified by its associated label.
- Cables shall be identified by a self-adhesive label in accordance with the Identification and Labeling section of this specification and ANSI/TIA/EIA- 606. The cable label shall be applied to the cable no further than 6" behind termination module, behind the faceplate on a section of cable that can be accessed by removing the cover plate.

B. Horizontal Distribution Cable Installation

- Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- Nylon or plastic locking cable ties, e.g. "Zip-Ties", shall not be used on this project.
- Contractor will provide a three foot "service loop" for all station cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
- Tie Wraps will not be allowed for supporting, bundling and/or dressing of any station cables on this project.
- Contractor will provide a three foot "service loop" for all station cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
- A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in all "common" conduit runs. "Common" Conduit Runs are those that house more than one cable or set of cables that do not specifically feed a Work Station Outlet. Examples of "Common" Conduit Runs are: floor/ceiling penetrations, stub-throughs, distribution conduits, all conduits between J- boxes, etc.
- Cable raceways shall not be filled greater than the TIA/EIA-569-A maximum fill for the particular raceway type or 40%.
- Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- Pulling tension on 4-pair UTP cables shall not exceed 25-lb for a four-pair UTP cable.
- The Cable Support System shall be installed in such a way that will allow for future cables to be added and to provide sufficient protection of all cable.
- For all installs where station cables are not installed in a continuous conduit run the following guidelines will apply. The Contractor will be responsible to reinstall all cables and pathways that do not meet with the following at no additional cost to the Owner:
 - J-hooks shall be installed to support all station cables every 14" – 28" inches.
 - All pathways shall be run at right angles. No diagonal pathways will be allowed unless otherwise noted on the drawings.
 - Horizontal cables shall be bundled in groups of no more than 25 cables per Caddy's CAT21 J-hook, no more than 40 cables per Caddy's CAT32 J-hook, and no more than 64 cables per Caddy's CAT64 J-hook.

- A separate J-hook is used for each group of cable. Specifically, CAT6 cable, fiber cable, and fire alarm are to have their own J-hook.
- At no point shall cable(s) rest on acoustic ceiling grids, acoustic panels, or lighting fixtures.
- All cables will be installed so that there is a minimum of 3" of clearance above all ceiling grid and tiles.
- All cables will be installed so that there is a minimum of 12" of clearance above all florescent lighting.
- All cables will be installed so that there is a minimum of 6" of clearance from all fire alarm and electrical system conduits.
- Cables shall not be attached to the ceiling grid or lighting fixture wires. The contractor will provide their own carriers wires to support their horizontal cabling.
- All cables shall be installed above fire-sprinkler systems and plumbing system fixtures and devices. Cables shall not be attached to or supported by these fixtures and/or their ancillary equipment or hardware.
- The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- Contractor is responsible for sealing around all cables that penetrate fire rated barriers.
- Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

C. Horizontal Cross-Connect Installation

- Cables shall be cleaned, dressed, and terminated in accordance with the recommendations made in the TIA/EIA-568-A standard, manufacturer's recommendations and best industry practices. Contractor to verify standard network equipment can be installed without any interference from the cables. Equipment typically is installed directly above and/or below the panel.
- The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
- All UTP cables shall have no more than 6.4mm 1/4 inch) of pair untwist at the termination point.
- Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- All cables shall be neatly bundled in groups of 24 and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame. Contractor will use Velcro strip to bundle cables together. The use of Tie –Wraps is not permitted.
- Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

D. Backbone Cable Installation

- Backbone cables shall be installed separately from horizontal distribution cables.
- Each individual cable is to be labeled. See details sheets for labeling examples. Cable type and from/to are required. Each cable to be labeled at any accessible point, including, but not limited to, pull boxes, Christy boxes, junction boxes, and any pass through location.
- Where possible the backbone and horizontal cables shall be installed in separate conduits.
- Where possible backbone cables of the same type shall be combined in conduit runs to

maximize conduit fill ratios.

- Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- Pulling tension on Backbone cables shall not exceed the manufacture's limitations.
- The minimum bend radius for all Backbone cables is 16 times the cable diameter or the manufactures specification, whichever is greater.
- Cable slack shall be provided in every pull box, junction box, cabinet, entry facility, telecom room and termination enclosure.
 - 25 feet of slack per cable shall be mounted on a service ring inside the enclosure.
 - Entry & telecom rooms & cabinets: Minimum 25' feet coiled in re- closeable storage ring.
 - If 25' is not possible, contact the owner and discuss an agreeable amount of slack, followed up with an confirming RFI.
 - Minimum of 25' of slack in each vault and a minimum of 15' of slack in any other type of box (pull box, Christy box, pass through space, etc).
- All OSP cables may not penetrate more than 50ft into the buildings before be terminated or splices to cable with a fire resistant jacket, unless the jacket is indoor/outdoor rated.
- A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

E. Backbone Cross-Connect Installation

- Cables shall be cleaned, dressed, and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturer's recommendations and best industry practices.
- Bend radius of the cable in the termination area shall not exceed 16 times the outside diameter of the cable.
- All cables shall be neatly bundled and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks.
- Contractor will provide a minimum of a 3 foot "service loop" for each backbone cable before terminating to allow future rearrangement. Cables will be coiled and secured above the ceiling where possible or to the Telco Backboard where entrance point is from the floor.
- Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame no less than 18" from the finished floor.
- Contractor shall provide a machine label 1ft. to 2ft. from the entrance point of the TR and 6in. to 12in. from the termination point on each backbone cable. Cable shall be easily identified and fully legible without removing the bundle support ties.

F. Cabinets, Racks, Enclosures and Ladder Rack Installation

- Wall Mount Racks/Cabinets shall be securely attached to the Telco Backboard using minimum 5/16" hardware or as required by local codes. Mounting rails shall be adjusted to the proper depth to allow for the closing of doors when populated with network electronics. Coordinate with Owner for final depth required.

- Floor Mount Racks/Cabinets shall be securely attached to the concrete floor using minimum 3/8" drop-in anchor hardware or as required by local codes.
- All Floor Mount Racks/Cabinets will be either; secured on one side to the wall or attached to the closest wall with ladder rack.
- All Racks/Cabinets shall be braced to meet Zone 4 seismic requirements.
- Contractor will maintain a minimum of 36 inches of clearance from the front of the all rack/cabinets and all other obstructions.
- Floor Mount Racks/Cabinets shall be installed to allow for a minimum of 36" from rear and all other obstructions.
- All racks shall be grounded to the telecommunications ground bus bar.
- Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- The plywood bottom edge shall be mounted vertically no less than 12" above the finished floor.
- Contractor will provide all cutouts for the Electrical Contractors expansion rings and electric receptacles as shown on the drawings.
- Ladder Rack must be securely attached to walls, backboards, and racks/cabinets to comply with all Zone 4 seismic requirements.
- Ladder rack shall be installed so that there is a minimum of 8" of unobstructed clearance above rack.
- Ladder Rack shall be installed so that there is a minimum of 12" of clearance from all: florescent lighting, electrical conduits/circuits, and fire alarm conduits/devices.

3.2 IDENTIFICATION AND LABELING

- A. The labeling scheme for CAT6 cable is as follows for classrooms (verify with Owner prior to printing the labels):

When entering the room (if the room has multiple doors, the door designated as the primary entry door), label numbering shall start at one (1) and then increment as data drops are added going around the room, then any drops in the ceiling, and then any drops in the floor. For each room, numbering starts over at one (1). Each jack color starts at one (1) and increments for each additional jack of the same color. Label designations are based on jack color:

Blue = D# White = V# Yellow = W# Gray = A# Purple = C#

Patch Panel Label Format: RM# -

The first part of the label shall be the room number the data drop is located in, RM is part of the label, followed by the room number or room designation. The last part of the label shall be the type, as stated above based on jack color, then followed by the drop number. For example, RM3-D10 is room 3, data drop 10. RM3-V2 would be room 3, voice data drop 2.

The label format in the room: RM# --

The first part of the label shall be RM, followed by the room number/ designation the cabinet/rack is located in.

The second part of the label shall be the patch panel the cable is terminated on. The top most panel is A and continues down with B, C, etc... If multiple panels span more than one rack/cabinet, when standing in front of the rack/cabinets, the top left panel shall be A.

The last part of the label uses the label based on jack color, as stated above, and the drop number. Example, RM3-A-D10: Indicates the other end of the cable is in the cabinet/rack in

room 3, terminated on panel A, and the last portion, ie D10 in this example, was the tenth data drop in this room. The last portion, D10 in this example, would match the patch panel label, RM3-D10.

Label scheme for non-classroom buildings follows the above scheme, but the label number starts at 1 (one) for each type (D, V, W, A, C) and increments throughout the building and does not reset for each room/office. Start at one and do not repeat the number anywhere in the building (for each type).

- B. The approved system will comply with the TIA/EIA -606-A Class 2 designations and include at a minimum, identifiers for all major components of the system: telecommunication rooms, grounding bus bars, racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure.
- C. All label printing will be machine generated or hand-held printers using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.
- D. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
- E. All fiber cable labels are to include the type, count, from and to on each label. Any point the fiber is accessible shall be labeled. At a minimum, that would include the starting point, any Christy boxes, cabinets/racks, any rooms the cable passes through, and the ending point. Service loops provided and labeled at each location, a minimum of 25' in each vault and 15' minimum in a Christy box/any other box or pass through space.
- F. Labels are to be verified by Owner prior to printing. Labels are to include building/room designations used by the site. Do NOT use building/room designations from the plans unless approved by Owner in writing.

3.3 TESTING AND ACCEPTANCE

- A. General
 - 1. The Owner reserves the right to be present during any & all types of tests being performed.
 - 2. Contractor will notify the Owner/Owner's Representative 24 hours before commencement of testing.
 - 3. Upon receipt of the test documentation, the Customer reserves the right to have the contractor perform a 10% witnessed "spot testing" of the cabling system to validate test results provided in the test document, at no additional cost. If a significant amount of cables are marginal and/or fail during the "spot test" Contractor will retest the entire cable plant at no additional cost.
 - 4. Contractors shall provide proof of test equipment calibration prior to testing.
 - 5. Test equipment shall have been factory calibrated within six months of project testing dates.
 - 6. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of TIA/EIA-568-C, TSB-67 and TSB-95. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100%

useable conductors in all cables installed.

7. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Manufacturer's Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Cable Testing

1. Twisted Pair Cable

- All twisted-pair copper cable links (including backbone cables) shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below.
- Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
- Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-A Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

2. Category 6 Performance

- Follow the Standards requirements established in:
- ANSI/TIA/EIA-568-C.0 Wire Map
- Length Attenuation
- NEXT (Near end crosstalk)
- ANSI/TIA/EIA-568-C.2 Return Loss
- ELFEXT Loss Propagation Delay Delay skew
- PSNEXT (Power sum near-end crosstalk loss)
- PSELFEXT (Power sum equal level far-end crosstalk loss)
- A Level III or better test unit is required to verify category 6 performances and must be updated to include the requirements of TSB-95 and Amendment 5. Testers will be equal to Fluke Network's DTX CableAnalyzer™ Series.
- All testers shall have been recalibrated within 6 months of use on this project. Contractor will be asked to provide proof of recalibration.
- Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. The approved Level Three tester shall provide a printed document for each test that is also available in a downloadable file using an application from the test equipment manufacturer. The printed test results shall include a print out of all tests performed, and the individual test results for each cable.

C. Fiber Optic Cable Testing

1. Backbone Fiber

- Each fiber strand shall be tested for attenuation with an Optical Power Meter and light source and with an Optical Time Domain Reflectometer (OTDR) for actual length and splice/connector loss. Cable length shall be verified using sheath markings. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 shall apply.
- All fiber optic cables shall be tested from the site's MDF to each fiber terminals located in the IDF. The results of OTDR testing to define the length of each riser cable shall be documented. The Contractor shall conduct a power meter (loss) test of each fiber optic station and riser cable at both wavelengths, 850/1300nm for MM and 1310/1550nm for SM, A to B, B to A, and OSPL (OSPL is defined as $L_a + L_b$). No individual station or riser fiber link segment (including connectors) shall measure more than 2.0 dB loss.
- Tests shall be conducted using ANSI/EIA/TIA/EIA-526-14A, Method B. Test results evaluation for the panel to panel (backbone) shall be based on the values set forth in ANSI/TIA/EIA-568-C.2. The Contractor shall provide an electronic printout for each strand tested with the Power Meter and the OTDR.
- Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.
- All installed cables must meet or exceed the defined standards for performance. The Contractor shall take all steps necessary to repair or replace any optic not meeting the standard.
- Fiber optic riser and station cable test results shall be provided in electronic format to the Owner.

3.4 SYSTEM CLOSEOUT AND AS-BUILT DOCUMENTATION

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Owner's Representative/Engineer for approval. One (1) to be a hardcopy and two (2) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 calendar days of the completion of each testing phase. At the request of the Owner's Representative/Engineer, the telecommunications contractor shall provide copies of the original test results.
- C. The Owner's Representative/Engineer will request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.
- D. Test Results documentation shall be provided in two media, as listed above, one (1) hardcopy and one (1) on disk within three weeks after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment

name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, a bi-annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

- E. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.
- F. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
- G. The As-Built drawings are to include cable routes, outlet locations and the approved labeling identifiers. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
- H. Contractor will provide one laminated 11"x17" drawing at each IDF that includes the building layout for that IDF, along with the outlet locations and all of the approved labeling. The as-built/current layout is to be provided.
- I. Test results are to be submitted to the manufacturer and a copy of the warranty certification is to be provided to the owner.

END OF SECTION 27 20 00

SECTION 27 41 16
AUDIO VIDEO (AV) SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. This section covers the requirements for an audio video Integrator to provide equipment for, and install instructional classroom technology. This is intended to supply a complete instructional technology classroom that can be arranged in multiple configurations. There will be a multimedia display as primary projection. Flexibility, integration of multiple technologies and sources, and multiple user groupings are essential to this concept. As an example, all audio and image sources should be capable of being shown on the screen and heard in the classroom. The work covered in this document consists of furnishing all labor, material and services necessary to install a complete audiovisual system as indicated on the project drawings and in these specifications.
- B. Work included: Labor, materials and equipment necessary to complete the installation required for the items specified under this Division, including but not limited to:
 - 1. AV wall cabinet
 - 2. Wall Mounted TV Displays
 - 3. Flat Panel TV Support
 - 4. AV switcher
 - 5. Ceiling Speakers
 - 6. AV Control Panel
 - 7. AV Interface Plate
 - 8. Microphone System
 - 9. Video cabling
 - 10. Speaker cabling
 - 11. Control cabling
- C. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Electronic Industries Association (EIA):
EIA REC 127-49; Power Supplies.

EIA RS 160-51 Sound Systems.

EIA RS 299-A; Loudspeakers, Dynamic Magnetic Structures and Impedance.

EIA RS 310-A; Racks, Panels and Associated Equipment.

EIA SE 101-A--49; Amplifiers for Sound Equipment.

EIA SE 103-49; Speakers for Sound Equipment.

EIA SE 105-A; Microphones for Sound Equipment.

2. Underwriters Laboratories, Inc. (UL):

UL 13; Power-Limited Circuit Cables.

UL 50; Enclosures for Electrical Equipment.

UL 813; Commercial Audio Equipment.

1.3 1.03 SYSTEM DESCRIPTION

- A. This Section specifies the minimum requirements for the AV system in the classrooms and common room spaces.
1. Ceiling speakers/sound bar.
 2. Switcher, amplifier, network switch
 3. AV equipment enclosure
 4. HD Television Display.
 5. Display mounts.
 6. Wireless microphone.
 7. HDBaseT HDMI connector plates
 8. AV control panel.
 9. Video cabling
 10. Control cabling
 11. Audio cabling
 12. Wall mounted control panel.
 13. Video cabling
 14. Control cabling
- B. All new construction general purpose classrooms will meet this minimum standard. The standard will be met in major renovations wherever possible. The standard will be retrofitted

in existing general purpose classrooms according to an established upgrade plan. Provide a complete Audiovisual System for small to medium sized classrooms. The system switching and audio amplification equipment shall be securely mounted and concealed in an enclosure mounted in close proximity to the display device. Audio and image source equipment can be connected to the system and displayed via active (powered) interface panels located throughout the room. The audio and image signals from source devices shall be transmitted from the active interface panels over shielded UTP cabling architecture.

- C. Classroom Definition: A classroom that has fixed instructional media video projection capabilities, Internet connectivity at the teacher's station, student networking (wired and wireless), a document camera, Blu-ray and/or other multimedia input devices, standard laptop interface, multimedia control system that is connected to the network and capabilities for additional add-on modular features.
- D. Technology Enhanced Classrooms (TECs) use standardized control/interface systems and employ a standardized operational protocol. The principles of this recommendation are to establish desirable goals with respect to classroom design and installed technology. The TEC classroom standard includes control systems that have ADA, Section 508 compliant buttons that are discernible without activating the controls or buttons on the control panel, easily reached control panel locations, closed captioning, hearing assistance capability, and user friendly operator protocols among the features that are consistent with universal design principles

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and communications characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe system operation, equipment and dimensions and indicate features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
 - 5. Submit Manufacturer's installation instructions.
 - 6. Complete Bill of Materials listing all components.
 - 7. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 - 1. A detailed explanation of the operation of the system.
 - 2. Instructions for routine maintenance.

3. Pictorial parts list and part numbers.
4. Telephone numbers for the authorized parts and service distributor.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Audio Video System components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipping shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

- A. Units and components offered under this Section shall be covered by a 2-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings. The system described under this section are part of the Extron AV system but the manufacturers below will be accepted as alternates.
 1. Classroom AV Switcher
 - a. Extron
 2. System DTP Transmitter/Receiver
 - a. Extron
 3. AV Control Panel
 - a. Extron

4. Wireless Microphone
 - a. Extron
5. Projector
 - a. Panasonic
6. Projector Ceiling Support
 - a. Chief Mfg or approved equal
7. Apple TV
 - a. Apple
8. Speakers
 - a. Extron Ceiling Speakers
 - b. Or approved equal
9. Speaker Cable
 - a. West Penn or equal
10. Control Cables
 - a. Extron
 - b. Or approved equal
11. Video Cables
 - a. Extron
 - b. Or approved equal

B. Substitutions: Under provisions of Section 270010: Basic Communications Requirements.

2.2 GENERAL EQUIPMENT REQUIREMENTS

- A. The room will be equipped with a standard easy to operate interface (a tactile button keypad layout). The audio system may be monaural or stereo for program sound. The instructional media system will be controlled by a control system with a control panel mounted near the instructor area. System parameters can be monitored, administered and controlled over the data network. The instructional media equipment will be located within close proximity to the instructor area or through a Graphical User Interface (GUI) on a computer to allow for ease of operation during instruction.
- B. Acceptable functionality requirements are listed below categorized by type of equipment. Quantities are listed for movable, portable or loose equipment, and other selected entries. Where quantities are not listed, refer to the system drawings.
- C. The System components shall all be correctly listed and labeled by Underwriters

Laboratories Incorporated (UL) for their intended use.

- D. All products shall be new and under warranty at the time of installation. B-stock, previously installed, refurbished or used equipment shall not be provided on this project.
- E. Where the specification lists several manufacturers for a major item, or group of items, the AV Integrator shall provide that entire item from one manufacturer only.
- F. The Integrator shall provide all options, accessories and hardware necessary to meet the function of the design even if they are not specifically listed (i.e. mounting kits, separate or additional power supplies, input modules, transformers, etc.).

2.3 WALL/POLE VAULT EQUIPMENT SHALL BE THE STANDARD FOR ALL AUDIO VIDEO SYSTEMS IN TRAINING ROOMS SHOWN ON DRAWINGS

- A. Extron Pole Vault PVS 411D Digital Audio Video Switching and Control System. The Pole Vault Systems are complete package systems. The system shall use the following configuration per classroom system.
- B. Provide the following Audio Video System as an all-inclusive system as described below, one system for each room:
 - 1. Mounting - The audio, video, data connectivity components and display device, if applicable, shall be mounted using the following components.
 - a. Multi-Product Mounting Kit
 - 1) The multi-product mounting kit houses the key electronic components of the AV system including the switcher, audio amplifier and power supply. The kit shall support mounting in close proximity to the display device, and protect the contained components from tampering and theft.
 - 2. Media Source Switching:
 - a. System source selection and switching shall be provided by a PVS 407D Switcher.
 - 1) The switcher shall have two (2) inputs that each support connection to a dual input switching wallplate via one (1) female RJ-45 connector.
 - 2) Audio for switched video sources shall be carried on the same RJ-45 connections.
 - 3) The switcher shall have a switched auxiliary audio input to support audio from video sources that are directly connected to the projector or sources that only offer audio content.
 - 4) The switcher shall have one HDMI video output
 - 5) Connection from the switcher to the display device shall be provided with one HDMI to HDMI video cable.
 - 6) An onboard audio amplifier shall provide gain / volume adjustment from -10db to +10db, adjustable in 1 db steps. The speaker amplifier shall have two (2) channels, one (1) stereo (default) or dual (2) mono

channels via one (1) 5.0 mm 4 pole captive screw connector. The output of the amplifier shall be 25 watts (rms) per channel at 4/8 ohms.

- 7) In addition to the stereo / mono speaker output, an additional audio output that will produce line level output shall also be available. This line level audio output must be capable for being set at either "fixed" or "variable" and with Balanced or Unbalanced settings.
3. Media Source Control:
- a. Classroom media sources shall be controlled with a MediaLink Controller.
 - 1) The MediaLink Controller shall contain six tri-color, multi-status LEDs push-buttons for device selection and projector on / off control. A rotary volume control knob with five (5) LED volume indicators shall permit system volume level control.
 - 2) The MLC Controller shall feature Extron IP Link Ethernet for monitoring, scheduling and control. This IP technology shall enable the device to be controlled, scheduled and monitored over a LAN, WAN or the Internet using Extron Global Viewer or MLC controller software.
 - 3) The Controller shall contain a serial host port which shall consist of one (1) bi-directional RS-232 front panel 2.5mm mini stereo jack. This host connection port shall be for configuration and control of the controller itself and to install device drivers for the equipment to be controlled.
 - 4) The Controller shall also feature (2) bi-directional serial ports to provide device control. These two ports shall control the display device and PVS AV Switcher respectively via bi-directional RS-232 control via one (1) 3.5mm direct insertion captive screw connector.
 - 5) The MLC Controller shall also have two (2) configurable (via software) digital input / outputs for devices such as sensors, switches, LEDs and relays via one (1) 3.5mm 4-pole direct insertion captive screw connector.
 - 6) Connection from the MLC Controller to the display shall be provided by one (1) 50' Projector control cable.
 - 7) Connection from the MLC Controller to the PVS AV Switcher shall be provided by one (1) 50' Switcher Control cable.
4. Audio Speakers:
- a. Ceiling Speakers - In ceiling applications, one (1) pair of Extron FF120 speakers are used.
 - b. Two-way closed back ceiling speaker with internal transformer for 8 ohm direct and 70/100 volt operation
 - c. Driver Requirements
 - 1) Shall consist of a 6.5" (165 mm) long-throw, polypropylene cone woofer with moisture resistant coating

- 2) Shall consist of a 3/4" (19.1 mm) ferrofluid-cooled PEI dome tweeter that is mounted on a hexagonal tweeter bridge

d. Performance Requirements

- 1) Shall provide a frequency range of 65 Hz to 22 kHz, -10 dB below average SPL, measured on-axis in half space per IEC 60268-5
- 2) Shall provide a frequency response of 88 Hz to 22 kHz, +/-3 dB, measured in half space
- 3) Shall provide a power handling capacity of 65 watts (rms) continuous pink noise and 130 watts (rms) continuous program
- 4) Shall provide a nominal sensitivity of 88 dB SPL (1 W, 1 m) measured in half space
- 5) Shall provide a nominal impedance of 8 ohms per speaker
- 6) Shall provide a nominal conical coverage angle of 111° (1 kHz to 4 kHz)

e. Electrical Requirements

- 1) Shall support 8 ohm direct or 70/100 volt connection from power amplifiers
- 2) Shall provide a six-position, through-the-grille power tap selector
 - a) Shall provide selectable rotary switch taps for 70 volt operation, including 64 watts, 32 watts, 16 watts, 8 watts, and 8 ohms direct
 - b) Shall provide selectable rotary switch taps for 100 volt operation, including null, 64 watts, 32 watts, 16 watts, and 8 ohms direct
- 3) Shall provide speaker tap selector and selection guide on the front of the speaker
- 4) Shall provide a full range power limiter with the 8 ohm direct input, protecting the tweeter, woofer, and crossover
- 5) Shall support one incoming and one outgoing speaker level signal on one 4-pole, 5 mm captive screw connector
 - a) Shall support wiring multiple speakers using parallel or loop-through wiring
 - b) Shall support a maximum wire gauge of 12 AWG per connection point for a single wire
 - c) Shall support a maximum wire gauge of 16 AWG per connection point for two wires

f. Speaker Enclosure Requirements

- 1) Shall provide a thin-edged rounded bezel surrounding the grille

- a) Shall measure 11.09" (281.7 mm) in diameter from bezel edge to edge
 - b) Shall provide a white, paintable magnetically-attached perforated steel grille with black scrim
- 2) Shall measure 10.64" (270.3 mm) in diameter
 - 3) Shall measure 8.0" in height from front of ceiling tile to back of rear enclosure
 - 4) Shall weigh 9.4 lbs (4.3 kg) per speaker
 - 5) Shall require 9.3" (236.2 mm) diameter opening in mounting surface for speaker cutout

g. General Requirements

- 1) Shall be sold in pairs
- 2) Shall have a separable back can and baffle to support single trade and division of labor applications
- 3) Shall include modular V-rail and folding C-ring kits
- 4) Shall have a cable/conduit access plate that can be oriented for side or top connections
- 5) Shall have a 5-year parts and labor warranty
- 6) Shall be compatible with Extron SGK SF26C Square Grille Kit

5. 5. Microphones

a. Voice Lift Pro Microphones

- 1) Hand Held Microphone: VLH 302
- 2) Pendant Microphone: VLP 302

b. Voice Lift Wireless RF Receiver: VLR 302

- 1) The receiver is to be mounted within the system vault and is to be connected to the VoiceLift Receiver input on the PVS AV Switcher.
 - a) This device acts as the receiver of up to two room microphones and transmits their audio signal to the PVS AV Switcher for mix into the program content of presented material. The receiver has a contact closure that when wired and configured to the digital input of the MLC, can trigger instant alert messages to a designated text or email account.

c. Voice Lift Wireless RF Microphone Charging Station: VLC 302

- 1) The device shall be constructed of high impact ABS plastic and act as a

holding and charging station of up to two of the Extron VoiceLift wireless RF microphones. The power supply shall be used as a recharging station for the two microphones.

6. 6. Media Source Interfacing:

a. The media source equipment shall be connected to the audiovisual system via two (2) Active (powered) dual input, switching wall plates. These wall plates shall enable the system to display video, graphic data and audio from Laptop computers, tablets, Blu-rayplates, document cameras, streaming devices, tuners, etc. These active interface transmitters shall be placed in convenient locations throughout the classroom to facilitate easy connection of sources.

b. Two (2) PVT SW HDMI D, Dual HDMI Input Wallplate shall be used to connect two HDMI devices to the system and transmit the video and audio data from either source to the PVS AV switcher.

- 1) Twisted Pair Transmitter shall transmit high resolution digital video and audio over shielded UTP cable to the PVS AV Switcher
- 2) Wallplate shall offer two (2) female HDMI connectors for interfacing with video source devices
- 3) Wall plate shall fit in a standard, 2-gang electrical box and feature Decora® type faceplates.
- 4) One (1) stereo audio input on 3.5mm mini stereo jack shall be available for each video input
- 5) The output of the interface shall be via one (1) female RJ-45 connector
- 6) Connection to the PVS AV Switcher shall be via one (1) UL plenum rated shielded UTP cable.

7. 7. Data Connectivity

a. The audio video system shall incorporate features that expand access and connectivity to an existing data network

- 1) The PVS Switcher shall incorporate a three port network switch, allowing a single network drop to provide connectivity for the switcher, the MediaLink controller, and one additional device.
- 2) 2) The audio video system shall include a IP Link enabled MediaLink controller, also connected to the network switch in the PVS Switcher, allowing remote monitoring, scheduling and control of the system over a network.

8. 8. Energy Efficiency

a. The audio video system shall incorporate energy conservation features to reduce consumption and lower operating costs.

- 1) The system shall incorporate an Auto Power Save Mode with fast power-up that automatically deactivates the audio amplifier after 25 minutes of

inactivity. It quickly returns to full power status in less than one second upon signal detection

- 2) The system shall incorporate a Network Standby Power Save Mode that allows the amplifier, wallplates, VoiceLift receiver, and network switch deactivated when not in use.
 - 3) The system shall incorporate monitoring and scheduling of system peripherals, such as sources and displays, in order to deactivate them when not in use or alert to unauthorized use.
9. Priority Page Sensor

a. The PPS 35 Priority Page Sensor works with WallVault Digital Classroom AV Systems to automatically mute classroom audio during an announcement from a public address system. The sensor mounts to the face of the PA speaker and detects when audio is present, signaling the switcher to mute classroom audio for the duration of the announcement. The PPS 35 is compatible with the PVS 407D Wall Vault Digital switchers.

b. Features

- 1) Detects audio signal from a public address system speaker
- 2) Allows PVS 407D Digital Switcher to mute program audio during announcements from the public address system
- 3) 50' (15.2m) plenum cable included
- 4) Dimensions: 1.18" H x 0.79" W x 0.44" D (30mm H x 20mm W x 11.1 mm D)

2.4 2.04 APPLE TV

A. A. Apple TV 4K

1. Remote

- a. Bluetooth 4.0 wireless technology
- b. IR transmitter
- c. Accelerometer and three-axis gyro
- d. Lightning connector for charging
- e. Rechargeable battery
- f. Charging via USB to computer system or power adapter

2. Receiver

- a. HDMI 2.0a3
- b. 802.11ac Wi-Fi with MIMO; simultaneous dual band (2.4GHz and 5GHz)

- c. Gigabit Ethernet
- d. Bluetooth 5.0 wireless technology
- e. IR receiver
- f. Built-in power supply
- 3. Processor
 - a. A10X Fusion chip with 64-bit architecture
- 4. 4. System Requirements
 - a. Requires 802.11 wireless, Ethernet network, or Broadband Internet access
 - b. Requires 4K and HDR TV for 4K and HDR streaming
 - c. Requires acceptance of the software license terms at www.apple.com/legal/sla
 - d. Requires HDMI cable
- 5. Video Formats
 - a. H.264/HEVC SDR video up to 2160p, 60 fps, Main/Main 10 profile
 - b. HEVC Dolby Vision (Profile 5)/HDR10 (Main 10 profile) up to 2160p
 - c. H.264 Baseline Profile level 3.0 or lower with AAC-LC audio up to 160 Kbps per channel, 48kHz, stereo audio in .m4v, .mp4, and .mov file formats
 - d. MPEG-4 video up to 2.5 Mbps, 640 by 480 pixels, 30 fps, Simple profile with AAC-LC audio up to 160 Kbps, 48kHz, stereo audio in .m4v, .mp4, and .mov file formats
- 6. Audio Formats
 - a. HE-AAC (V1), AAC (up to 320 Kbps), protected AAC (from iTunes Store), MP3 (up to 320 Kbps), MP3 VBR, Apple Lossless, FLAC, AIFF, and WAV; AC-3 (Dolby Digital 5.1), E-AC-3 (Dolby Digital Plus 7.1 surround sound), and Dolby Atmos

2.5 CEILING PROJECTOR

- A. Projector Projector displays shall be installed for each audio video system. The display will be mounted on ceilings as indicated on drawings. Each team room display will be mounted to a 1.5" pole secured to a ceiling projector mount and a structural support at structural ceiling.
- B. Displays shall be manufacturers commercial grade. Minimum requirements are as follows:
 - 1. Brightness: 8000 Lumens
 - 2. Max. Resolution: 1920 x 1200 pixels

3. Technology: Laser LCD
 4. Aspect Ratio: 16:10
 5. Lens: Standard, Powered Zoom, throw ration: 1.6-2.8:1
 6. Dimensions: 22" x 8" x 17.5" with Lens
 7. Weight: 38 Lbs.
- C. Manufacturer: Panasonic #PT-MZ770U
1. Lens: PT-M770/MW730
- D. FSR Combination Wall Box
1. Telecom/AV/Power Wall Box
 2. FSR #PWB-100
 - a. AV & Data Pass Thru #SS-P2XLR
 - b. Decora Wall Plate #SS-DPLT-1

2.6 CEILING PROJECTOR SUPPORT

- A. Chief Manufacturing
1. Projector Mount: RPA Elite Universal #RPMA302
 2. 1.5" NPT Column
 3. Unistrut Adapter Support: CMA372

2.7 SYSTEM CABLE & CONNECTORS

- A. Speaker/Audio Cable: West Penn Wire #224 18 gauge shielded or equal
- B. HDMI Cable – Extron HDMI Ultra Series (Length as required) or equal
- C. Category 6A Digital Twisted Pair – Extron DTP 24P or equal
1. DTP 24 RJ45 Plug – Extron or equal
 2. AV Patch Cords – XTP DTP 24/X (X = length as required) or equal.
- D. Cat 6 Ethernet – Refer to Section 267113.
- E. RS232 Cable – Extron STP-20 or equal
- F. Connectors as required

PART 3 EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions. Do not commence with installation until all conditions are made satisfactory.
- B. All devices connected to equipment specified in this section shall bear the UL label and comply with the applicable National Electrical Code (NEC) standards.

3.2 INSTALLATION

- A. General:
 - 1. Integrator shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein. System setup information shall include each components proper mounting and alignment and properly verified signal pathways and operation. Proper operational and network support control functions shall be verified.
 - 2. Install audio video components as indicated on Drawings and in accordance with Manufacturer's instructions.
 - 3. Install in accordance with all local and pertaining codes and regulations
 - 4. Provide grounding of audio video equipment rack to building steel.
 - 5. Anchor and brace equipment racks to withstand seismic forces as required to meet Zone 4 earthquake compliance.
 - 6. Mount support devices for displays per AV design.
 - 7. All equipment and enclosures described in this specification shall be installed plumb and square per manufacturer's instructions.
 - 8. All equipment, except that designated as movable, portable or loose equipment, shall be secured and permanently attached to the permanent structure in a manner which will require the use of a tool (e.g.: screw driver, nut driver, etc.) for removal.
 - 9. All supports shall meet or exceed the load requirements of the intended application with a minimum safety factor of five.
 - 10. Provide support structure and hardware with a SAE Grade 8 load rating (min.).
 - 11. Utilize an Integrator with demonstrated experience in projects of similar size and complexity.
 - 12. Equipment shall be configured and in ready to use condition at the end of installation.
 - 13. Energize and commission equipment in accordance with manufacturer's instructions. Commissioning the system shall at minimum, consist of the

following:

- a. Install Global Configurator software on PC. Download from www.extron.com, or install from Extron Software Products CD
14. Make the following MLC cable connections
 - a. Power
 - b. Local Area Network (LAN)
 - c. Classroom Source Devices
15. Configure MLC 104 IP Plus Series using Global Configurator
16. Download device drivers for all source and projection devices
17. Create a new Global Configurator project file
18. Add a device and set its IP address
19. Define the location of the new Media Link Controller device
20. Save the new Global Configurator file
21. Configure e-mail server
22. Configure e-mail messages
23. Configure contacts
24. Assign serial device drivers
25. Assign IR drivers
26. Configure the front panel (All buttons are required to have a function assigned: source or control)
27. Configure associated control modules
28. Create a shutdown schedule
29. Create a lamp hour notification
30. Create a disconnect notice
31. Build the Global Configurator file
32. Upload the Global Configurator file
33. Launch GlobalViewer
34. Test the MLC's setup for proper control and support of the classroom
35. Installation of the Extron system is covered in full detail at

<http://www.wexton.com/training/index.aspx>

B. Cable Installation:

1. All cabling shall be installed in a continuous steel raceway system to accessible ceiling and shall be sized as indicated on the Drawings.
2. Route wiring continuous between devices without splices.
3. Cables shall be installed to avoid sharp bends or physical distortion.
4. All cable pulling shall comply with the requirements of Division 26: Building Wire and Cable.
5. All audio circuit wiring external to the equipment cabinets shall provide for the shields to be insulated from ground and other audio circuits. The shields shall be grounded at the point of lowest audio level only and shall be free of any other ground for their entire length. Where two cables join or connect together on a terminal strip, the shield shall be insulated from all other conductors and connected together in a manner similar to the cable conductors.
6. Cables shall have a minimum 24" service loop at each end and stored above ceiling on J-hooks.
7. All cables shall be identified with Brady or E-Z code wire markers. There shall be no splices between terminal points.
8. Upon completion, each line shall be tested for continuity, total resistance and free of interference pickup and free of grounds, opens and shorts. Each piece of equipment shall be tested under all normal and extreme conditions of function. All speakers shall be double checked for proper angles of coverage. Displays shall be double checked for level orientation .
9. Wire shall be numbered and tagged at both ends and be indicated on the Record Drawings (this includes all spares).

C. Projector Displays:

1. Mount displays to ceiling structure with unistrut and unistrut adapter, projector mount and 1.5"NPT support column.
2. Mount displays to ceiling and support per manufacturers requirements..

END OF SECTION 27 41 16

**SECTION 274200
CLASSROOM AUDIO/VISUAL SYSTEMS**

PART 1 – GENERAL

1.1 Scope of Work

- A. This document describes the products and execution requirements relating to furnishing and installing Classroom Audio/Visual systems. Classroom Audio/Visual System Electronics and installation requirements are covered under this document.
- B. The intent of these Specifications is to provide a complete classroom audio/visual system and it is the responsibility of the bidding Contractor to provide a complete solution. It is also the responsibility of the Contractor to provide all material necessary to provide a complete system even if the material is not described specifically in the following documentation. All questions concerning non-specified product and services will be address to the Owner's Representative before the Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that they [the Contractor] have provided a competent bid for a complete solution.
- C. Contractor to include labor costs to install owner provided projector in each room an Extron system is installed in. If not installed, a credit is to be issued to owner for the labor costs not preformed.
- D. Excluded in this scope: projection surface & projection.

1.2 Related Work in Other Sections

- A. Division 270000 for all general conditions and work required by the contractor.
- B. All 120VAC power conductors and conduits associated with power circuits to all equipment locations shall be furnished and installed by Division 260000 contractor.
- C. All raceway systems including but not limited to conduit, j-boxes, outlet boxes, floor boxes, & surface mounted raceway shall be furnished and installed by Division 260000 and 270528 contractors.

1.3 Approvals

- A. The system shall maintain the following listings and/or approvals from the following agencies:
 - 1. (UL) Underwriters Laboratories
 - 2. (FCC) Federal Communications Commission

1.4 Contractor Qualifications/Quality Assurance

- A. Safety and Indemnity
 - 1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 "1.5 A. Safety & Indemnity".
- B. Contractor Qualifications
 - 1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 "1.5 B. Contractor Qualification".
- C. Quality Assurance
 - 1. Contractor shall comply with all requirements as specified in Section 270000 "1.5 C. Quality Assurance".
- D. Warranty
 - 1. Contractor shall comply with all requirements as specified in Section 270000 "1.8. Acceptance & Warranties".
 - 2. Contractor to provide liaison services of manufactures THREE YEAR WARRANTY.

1.5 Submittal Documentation

- A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 270000 "1.6 Submittal Documentation".
- B. Contractor shall also include in their Submittal Package:
 - 1. A shop drawing depicting all system components and interconnections.

1.6 Equivalent Products

- A. All Contractor provided product in this Specification are those of: 1. Extron Systems
- B. Pre-Approved Equals:
 - 1. Equivalent Products must comply with Section 274200 1.8 Classroom Audio/Visual System Specification contained within this document.
- C. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 270000 "1.7 Equivalent Products".
- D. Equivalent products (equals), may be substituted for the specified Extron Systems by submitting a "Substitution Request Form" (see attached). The "Substitution Request Form" must be submitted to the Architect and District for evaluation. A complete product data submittal must be submitted along with the "substitution Request Form".

1.7 Technology Clause

- A. As technology advances, it is understood that improved or enhanced products may supersede existing products in both price and performance and yet be essentially similar. This request for bids seeks to address the rapid advances in technology by allowing functionally similar or identical products that may be introduced in the future, during the term of this bid, to be included under the general umbrella of compatible product lines and are thus specifically included in this bid document.
- B. Discontinued or end of life products shall be replaced with an equal product to the original specified product at no additional costs to the owner.

1.8 Extron Systems only -- Classroom Audio/Visual System Specification (Not used in this project)

- A. Control System
 - 1. The Control System shall provide on/off for all connected devices, projector control, audio and video switching, and volume control for all connected audio.
 - 2. Control System shall be operated from a wall mounted control panel located at the front of the classroom.
 - 3. The Control System shall use either RS-232 or Ethernet for projector control.
 - 4. The Control System shall be attached to the site's IP data network via CAT 6 ethernet cabling.
 - 5. The Control System shall also be remote accessible via IP data network using administration software, web interface, as well as an iOS device.
 - 6. The control panel shall be mounted within 3' to the left side of the projection surface (while facing the surface) at 48" aff, UON. Field verify placement with District staff.
- B. Switcher
 - 1. System shall incorporate a switching system that can allow for a minimum of two RGB inputs and two HDMI inputs.
 - 2. System cannot rely on projector for switching of any kind. Projector is only to be used for video output only.
 - 3. Switcher must output via a digital interface (HDMI, DVI, Display Port).
 - 4. Switcher must be able to output audio from both analog and digital sources to amplifier/speakers.
 - 5. Switcher components shall not be visible nor shall it be placed in existing cabinetry.
- C. Architecturally mounted AV Inputs
 - 1. One double-gang wallplate with one (1) 15pin VGA video input and a 3.5mm TRS audio connection as well as a (1) HDMI input located to the left of the screen.
 - 2. One double-gang wallplate with one (1) 15pin VGA video input and a 3.5mm TRS audio connection as well as a (1) HDMI input located to the right of the screen.
 - 3. All structured cabling from AV wallplates to switcher shall be over twisted-

pair cabling. All AV input sources must have the appropriate media and cabling converts on both ends.

- D. Audio and speakers
1. System shall provide sound amplification for all audio and video sources. Voice (microphone) amplifications is not required unless otherwise noted.
 2. Projector may not be used to switch, de-embed, or pass-through audio.
 3. Speakers shall be flush mounted ceiling speakers located at the center of the room for even sound distribution.
- E. Manufacturer warranty three years parts and labor.
- F. Projectors and Mounting.
- Projectors are owner provided, contractor installed/configured. Verify projector type and mount location with owner prior to installation.
1. Projector mounts shall be installed on the walls whenever possible. Please verify with owner if there are any questions as to which type to use.
 2. Ceiling Mounted Environments.
 - Projector mount must be designed for use with drop ceilings.
 - Projector shall be mounted in the ceiling centered on the learning wall, 10'-0 (+/- 6" or nearest tile) from screen/whiteboard or nearest grid alignment +/-6".
 - Classrooms that have a Smart Board, centered on the board, 10'-0 (+/- 6" or nearest tile) away from board.
 - Classrooms that only have a white board, centered on the board, 10'-0 (+/- 6" or nearest tile) from white board.
 - Classrooms that have an existing screen, centered on the screen, 10'-0(+/- 6" or nearest tile) from screen.
 - Contractor to contact CUSD if multiple conditions exist in the room or if anything is not clear on location of mounting equipment.
 3. Wall Mounted Environments.
 - Wall mounts shall be aesthetically pleasing. Structural support hardware shall be covered by an enclosure and should not be visible. Contact Owner if there are any issues. Wall mount is to be mounted as close to the top of the projection surface as possible to allow for any interactive devices.
 - Wall mount extension arm shall not exceed 36" from wall and shall be centered on the learning wall, which should align with the center of the projected surface.
 - Wall mount must support a projector weighing up to 20 pounds at full extension.
- G. Classroom that are non typical in shape (interior classrooms) or have offset/split whiteboards, both the control panel and projector mount will have to be located on an individual basis.
1. Contact Owner to locate the mount and controls in those rooms.

1.9 TYPICAL CLASSROOM SETUP

- A. Control System
 - 1. There is no control system. The projector will be controlled with the remote control.
- B. Switcher
 - 1. There is no Switcher. The inputs will be controlled with the remote control.
- C. Architecturally mounted AV Inputs
 - 1. One single-gang wallplate with one (1) 15pin VGA video input and a 3.5mm TRS audio connection as well as a (1) HDMI and (1) USB input located to the left of the projection surface.
 - 2. One 12 inch active USB repeater pigtail is to be included and connected to the wallplate above.
- D. Audio and speakers
 - 1. Speakers shall be flush mounted ceiling speakers located at the center of the room for even sound distribution. Contractor to supply the cables from projector, to the amplifier, and on to the speakers.
- E. Projectors and Mounting.
 - Projector is owner provided, contractor installed/configured.
 - 1. The typical install will be with a Wall Mounted projector.
 - Wall mounts shall be aesthetically pleasing. Structural support hardware shall be covered by an enclosure and should not be visible. Contact Owner if there are any issues. Wall mount is to be mounted as close to the top of the projection surface as possible to allow for any interactive devices.
 - Wall mount extension arm shall not exceed 36" from wall and shall be centered on the learning wall, which should align with the center of the projected surface.
 - Wall mount must support a projector weighing up to 20 pounds at full extension.

PART 2 – PRODUCTS

The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the project drawings. In the event of a discrepancy between the specifications and the project drawings, the greater quantity or better quality shall be furnished.

- 2.1 Classroom Equipment for all rooms have the same system with either wall mount or ceiling mounted speakers. Ceiling mounted speakers are preferred unless ceiling configuration does not allow for it.
- A. STANDARD SYSTEM:
Wall Mounted UST projector – Owner provided, contractor installed and configured.

--Projector comes with a USB cable to connect from the projector to a laptop. This cable should be used to connect to the USB pigtail and wall plate. If not used, contractor responsible to provide the appropriate cable.

Actiontek Screenbeam 750W – Owner provided and configured, contractor installed.

--This unit provides wireless connectivity to the projector and plugs into the HDMI input on the projector. Connect it to HDMI 1 on the projector. Unit is to be secured to the wall mount arm with Velcro.

Wallplate with USB/VGA/3.5mm Audio/HDMI – Contractor provided, configured and installed.

COVID – W1408-WH-P-A-ALT

COVID - CWP 0010-USB-BA-AC8”

--Contractor to provide the VGA, 3.5mm, USB, and Active HDMI cable that connects from this wallplate to the projector. The USB cable is provided with the projector and contractor is to connect the USB cable from the projector to the pigtail, which connects to this wall plate. Note the provided cable is 15’ long. If a longer length is needed, contractor is to provide the active USB cable needed to connect from the projector to the wallplate.

--The 3.5mm cable is to be provided by the Contractor and is to be connected to the wallplate to the audio input on the projector.

Two ceiling mounted speakers – Contractor provided, installed, and configured. Extron 42-120-13, FF 120T Speakers (one pair)

Extron Amp -- Contractor provided, installed, and configured. Extron 60-1449-01, MPA 601-70V

Audio Cable -- Contractor provided, installed, and configured. Extron 18 AWG speaker cable.

- B. Voice Amplification System (Not included in bid unless shown in drawings or requested by CUSD) If a voice amplification system is requested, add the following to the above Extron PVS 400D configuration.
 - 1. (1) Extron VLM 2000H - VoiceLift Pendant and Handheld Microphone System

PART 3 – EXECUTION

3.1 General

- A. All Work described in this specifying document and on the Project drawings shall be performed in accordance with the acknowledged Professional and Industry standards and practices. All installed equipment shall meet and/or exceed the specified manufactures regulations.
- B. The Contractor shall maintain a competent supervisor and Manufacture

- C. Certified Technician assigned to this installation for the duration of the Project. Furnish and install all materials, devices, components and equipment required for a complete and operational system.
- D. It is the contractor's obligation to inform the Owner and/or the Owner's Representative of any and all conflict's, between the project documents and the onsite conditions.
- E. It is the Contractor's responsibility and obligation to coordinate with all necessary trades to ensure the integrity and compliance of the Manufacture and Industry standards are meet during the duration of the installation.

3.2 Installation

- A. Furnish components, wire, connectors, materials, parts, equipment, labor, etc. necessary for the complete installation of the systems in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.
- B. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the National Electrical Code.
- C. Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three. All equipment shall be installed so as to provide reasonable safety to the operator. Supply adequate ventilation for all enclosed equipment items which produce heat.
- D. Furnish the system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed, or manufactured to UL standards.
- E. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end.
- F. Route cables and wiring according to function, separating wires of different signal levels (video, microphone, line level, amplifier output, AC, control, etc.) by as much physical distance as possible. Neatly arrange and bundle all cables loosely with velcro cable ties. Cables and wires shall be continuous lengths without splices.
- G. All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.
- H. Mechanical connections shall be made using approved connectors of the correct size and type for the connection. Wire nuts will not be accepted.
- I. Label all wires as to destination and purpose. Clearly and permanently label all jacks, controls, and connections with permanent labels, unless otherwise noted.

- J. Contractor to include labor costs to install owner provided projector in each room an Extron system is installed in. Projector is to be aligned to designated screen/board, as directed by Owner. If not installed, a credit is to be issued to owner for the labor costs not preformed.
- K. Contractor is to turn over to the owner any items included with the kit, including but not limited to, any extra cables, labels, templates, tools, and manuals. All items to be placed in a bag with the room number on the bag.
- L. Contractor to label control panel buttons 1 - 4 and label the inputs accordingly. Verify with Owner prior to printing.
- M. One CAT6 data cable shall be connected from the Control Panel to the nearest IDF (Extron installs only).
- N. Projector (whether owner contractor provided or owner provided) and Control Panel are to be assigned an IP address (contact Owner on what to use). Assigned address to be documented for every unit and provided back to Owner. Contact owner for sample spreadsheet to use.
- O. All wall mounted projectors come with interactive capabilities via pens. Contractor to calibrate the system prior to turning over to Owner.

3.3 Programming

- A. Contractor shall provide all necessary programming to provide a complete operating Audio Visual System.
- B. Contractor shall include in their bid a one (1) hour planning meetings with the owner and their Representatives to outline all specific programming issues, as well as, but limited to:
 - 1. Contractor will be informed of any specific requirements for use of the system.
 - 2. Contractor will provide overview of system capabilities.
 - 3. Contractor will address all concerns of the Owner and their Representatives.
- C. All Control System Programming shall be custom produced for this installation by qualified factory-trained installer and software support shall be provided to owner for 12 months after the final acceptance of this project. AV contractor to work with the Owner's staff to assign IP addresses and set-up of all A/V equipment.
- D. Any programming needed to configure the interactive capabilities is to be included and completed by the contractor.

3.4 Testing

- A. The completed AV systems shall be physically inspected by the Owner's representative to assure that all equipment is installed in a neat and professional manner, and in accordance with these Specifications.

- B. The final system testing and commissioning shall be performed after all installation and initial testing has been completed by the Installer, but prior to any use of the systems.
- C. The Contractor, prior to requesting systems testing and demonstration to the Owner's representative, shall ensure that all systems are in first-class working condition and free of short circuits, ground loops, parasitic oscillations, excessive hum and noise, RF interference, or instability of any form.
- D. The Contractor shall be responsible for properly performing all setup and alignment of systems, and all assembly and setup of portable equipment.
- E. The Contractor to provide a listing of each room/location and sign off that each part of the system was tested and the result of the test. Contact owner for an example form to use.

3.5 System Commissioning

- A. Audio Visual System Commissioning
 - 1. In the presence of the Owner's Representative the Contractor shall perform the attached functions listed below:
 - (1) Inspection of all terminations
 - (2) Inspection of all inputs and output devices
 - (3) Verify polarity of speaker system and connectors (4) Check wire types at all locations
 - (5) Verify connector types
 - (6) Check Impedance of speaker lines (7) Verify coverage of speaker system
 - (8) Check general operation of control surface
 - (9) Check programming of control surface for routing and proper function
 - (10) Check power sequencing
 - 2. All testing documentation will be supplied as a part of the Contractors As-built Documentation.
- B. Contractor will include in their bid price six (6) hours for onsite commissioning. Contractor will provide the installation technician who was responsible for this project to be present at the system commissioning to tune, fix, repair, replace all system components that do not operate within the tolerance as set forth in this specification, the project documents, and industry standards.
- C. The final acceptance of the system by the Owner will be based upon the report of the Owner representative following inspection, testing, and commissioning. A list of items in need of completion or correction shall be generated by the owner, which must be corrected by the Installer before final acceptance will be granted.

3.6 Training

- A. Contractor shall provide no less than two (2) one (1) hour training sessions.
 - 1. The first training session will be a "Train the Trainer". The owner will

appoint their representative to be provided extensive training so that he/she will be able to provide additional support once the project has been completed.

2. The additional training session will be provided as a general overview of the system operation for large groups or several smaller groups as designated by the owner. Usually these additional training events will coincide with a school function when the sound system will be used.
3. Provide sign in sheets for all training events. Deliver to architect in the close out documents.

3.7 Warranty

- A. Contractor will provide a minimum of a 1 year Workmanship Warranty that includes Parts and Labor.
- B. All equipment provided under this specification shall be warranted to be free from defects in materials and workmanship for a period of 12 months from the notice of completion.
- C. The Contractor shall maintain regular service facilities and provide a qualified technician familiar with the work specified for this project. Contractor will respond to all notice of malfunction from the Owner within 24 hours of receiving trouble call. As part of this warranty, the Contractor shall provide, at no expense to the Owner, all material, devices, equipment, and personnel necessary and resolve malfunction and/or to provide alternate facilities, services, or equipment for the duration of repairs to any defective work as described in this section.
- D. All repairs and service under warranty shall be at the jobsite unless in violation of manufacturer's warranty, wherein contractor shall provide substitute equipment for the duration of repairs. Transportation of substitute or test equipment and personnel to and from the jobsite shall be at no expense to the owner.
- E. All repair and service work under warranty work, except emergency repairs can be performed during regular working hours of regular working days. Emergency repairs shall be made when a system or component malfunctions during use, and shall be performed on an immediate basis. All work shall be performed by personnel in the employ of contractor, having specific experience in the work of this specification and shall not be subcontracted or assigned to another company for service, unless Owner has approved such assignment in writing, in which event contractor shall nevertheless be responsible to the Owner for such work.

3.8 System Documentation

- A. Upon completion of the installation, the contractor shall provide four copies (one hardcopy and three electronic copies) of Project Close-Out Documents to the Owner. Documentation shall include the items detailed in the sub-sections below:
 1. Maintenance and Operation Manuals

2. All System source codes and passwords must be handed over to, and become property of the Owner upon completion of this project.

3. As-Built Drawings

- B. The As-Built drawings are to include cable routes, outlet locations and the approved labeling identifiers, equipment layout and system single line drawings. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD 2008) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
- C. Contractor to provide a document with the site and reseller at the top of the page and a table listing the Room and MAC of the controller for every room a system is installed. The sticker on the control panel shall be attached to this document. Assigned IP addresses and MAC addresses are to be included in the documentation.

END OF SECTION 27 42 00

**SECTION 27 51 00
SCHOOL COMMUNICATIONS AND CLOCK SYSTEMS**

PART 1 GENERAL

1.1 SUMMARY

A. Work Included

1. 1. Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Specifying Documentation.

1.2 RELATED WORK IN OTHER SECTIONS

- A. All 120VAC power conductors and conduits associated with power circuits to all equipment locations shall be furnished and installed by Division 26 contractor.
- B. All raceway systems including but not limited to conduit, j-boxes, outlet boxes, floor boxes, & surface mounted raceway shall be furnished and installed by Division 26 contractor.

1.3 SCOPE OF WORK

- A. This document describes the products and execution requirements relating to furnishing and installing Paging systems. Paging System Electronics and installation requirements are covered under this document.
- B. The intent of these Specifications is to provide an extension of the existing school communication system and it is the responsibility of the bidding Contractor to provide a complete solution. It is also the responsibility of the Contractor to provide all material necessary to provide a complete system even if the material is not described specifically in the following documentation. All questions concerning non specified product and services will be address to the Owner's Representative before the Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that they [the Contractor] have provided a competent bid for a complete solution.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of devices, typical installation details, and mounting details will be provided as an attachment to this document. The successful vendor shall meet or exceed all requirements for the cable system described in this document.
- D. This section includes a fully functional school internal communications and system incorporating safety, including but not limited to the following features:
 1. The system shall provide complete control employing state of the art Voice Over Internet Protocol technology including the minimum functions listed:
 - a. Two-way IP loud speaking internal communications
 - b. Event announcement
 - c. Emergency announcement that will override any pre-programmed zones assuring that all emergency notifications are heard at each speaker location.

- d. Capability of prerecording emergency announcements that can be simply activated by
 - a soft key or dedicated call switch.
- e. Safety Paging and Evacuation tones
- f. Distributed electronic architecture that does not require home run wiring for each device/circuit
- g. Atomic time synchronization with class change tones utilizing multiple programmable schedules for each zone
- h. Paging and Program distribution
- i. Incorporate district-wide announcements, either live or recorded through a direct connection to the WAN and telephone system.
- j. Any authorized administrator shall be able to call from outside the school into any classroom, zone or entire campus directly via the School District supplied telephone network. This shall allow remote monitoring and two-way communication from outside the school building as well as paging into the system. This feature shall allow the user access to all functions via a user defined PIN code. Compliance with NEMA standard SB-40 for emergency communications in K-12 schools.
- k. Authorized system users shall be able to record a minimum of ten (10) automated messages with emergency instruction and replay them. Automated message strings shall be either automatically distributed as part of the dial string, manually played from a single button access on the phone or through the master clock as a timed event.
- l. The system shall allow users to exclude their classroom from paging and tones in the event of testing or other activities that should not be interrupted. This exclusion will not affect emergency paging. This exclusion must have the ability to 'reset' at midnight.
- m. The system shall synchronize its system time to the network time server or a web- based time server.

2. 2. Clock System

- a. All clocks will be provided and installed by the owner.

1.4 CONTRACTOR QUALIFICATIONS/QUALITY ASSURANCE

- A. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0010 Basic Communications requirements.
- B. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0010 Basic Communications requirements.
- C. Contractor shall comply with all requirements as specified in 27 0010 Basic Communications requirements for quality assurance

1.5 EQUIVALENT PRODUCTS

- A. All products approved in this specification are those of the current system installed on the school site.
 - 1. Bogen NyQuist 7000
 - 2. Equals will not be accepted

1.6 SUBMITTAL DOCUMENTATION

- A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 270010 Basic Communications Requirements

1.7 WARRANTY

- A. Contractor shall comply with all requirements as specified in Section 270010 Basic Communications Requirements

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Product manufacturer shall be:
 - 1. Bogen Communications: Nyquist 7000

2.2 PAGING EQUIPMENT

- A. IP Indoor speakers
 - 1. Nyquist VoIP Speakers
 - a. 10/100 Ethernet connected speaker with integral PoE 10 watt amplifier.
 - b. Wall Model: NQ-S1810WT
 - c. Ceiling Model: NQ-S1810CT
- B. IP Exterior Speaker Horns
 - 1. 10/100 Ethernet connected speaker with integral PoE 15 watt amplifier.
 - 2. Wall Model: IP-HVP
 - a. Flush Mounted Back Box: IP-FEST-HVP
- C. Digital Emergency Call Switch
 - 1. The approved call switch is the: NQ-E7020
 - a. The wall-mounted switch shall use a full spectrum LED ring to confirm user actions, to indicate status (for example, changing color from solid color to

blinking), or to acknowledge a button press when a user initiates a call or when a call has been terminated.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Furnish components, racks, wire, cabinetry, connectors, materials, parts, equipment, labor, etc. necessary for the complete installation of the systems in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.
- B. Installation shall follow standard broadcast wiring and installation practice, and shall meet or exceed industry standards for such work.
- C. Wire not installed in equipment racks, not portable, unrated ceiling space, or not installed in conduit shall be fire rated and meet all applicable codes.
- D. All signal equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.
- E. All cables including control, network, low-voltage power, video and audio which are required to be on floor will be properly covered and secured so that they are protected by strain and safe of trip hazards.
- F. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the California Electrical Code.
- G. Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three. All equipment shall be installed so as to provide reasonable safety to the operator. Supply adequate ventilation for all enclosed equipment items which produce heat.
- H. Furnish the system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed, or manufactured to UL standards.
- I. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to insure that constant polarity is maintained.
- J. Terminate all unused inputs and outputs with proper precision shielded resistors.
- K. Route cables and wiring within equipment racks and cabinetry according to function, separating wires of different signal levels (video, microphone, line level, amplifier output, AC, control, etc.) by as much physical distance as possible. Neatly arrange and bundle all cables loosely with hook and loop cable ties. Cables and wires shall be continuous lengths without splices.
- L. All system wire, except spare wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heat shrink type tubing shall be used to insulate and dress the ends of all wire and cables. Include a separate tube for the ground or drain wire.

- M. All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.
- N. All solder joints and terminations shall be made with resin-core silver solder. Temperature regulated soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns or temperature unregulated irons shall be used on the job site.
- O. Mechanical connections shall be made using approved connectors of the correct size and type for the connection. Wire nuts will not be accepted.
- P. Each mechanical connector shall be attached using the proper size controlled-duty-cycle ratcheting crimp tool which has been approved by the manufacturer of the connectors.
- Q. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on the job site.
- R. Label all wires in racks and console as to destination and purpose. Clearly and permanently label all jacks, controls, and connections with permanent engraved laminated plastic labels or by engraving and filling mounting plates, unless otherwise noted. Attach laminated plastic labels with contact cement, being careful to clean off excess or visible cement. Embossed or printed label tape, and press-on or lift-off lettering systems will not be accepted. All labeling shall be completed prior to final system inspection.
- S. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.
- T. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
- U. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.
- V. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- W. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.2 PROGRAMMING

- A. Contractor shall provide all necessary programming to provide a complete operating paging system.
- B. Contractor shall include in their bid one (1) two (2) hour planning meeting with the owner and their Representatives to outline all specific programming issues, as well as, but limited to:
 - 1. Contractor will be informed of any specific requirements for use of the system.
 - 2. Contractor will provide overview of system capabilities.

3. Contractor will address all concerns of the Owner and their Representatives.
- C. Impedance and Level Matching: Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.
- D. Control circuit wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacture to provide control functions as indicated or specified.

3.3 GROUNDING

- A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
- B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.
- C. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.4 TESTING

- A. The completed systems shall be physically inspected by the Owner's representative to assure that all equipment is installed in a neat and professional manner, and in accordance with these Specifications.
- B. The final system testing and commissioning shall be performed after all installation and initial testing has been completed by the Installer, but prior to any use of the systems.
- C. The Contractor, prior to requesting systems testing and demonstration to the Owner's representative, shall ensure that all systems are in first-class working condition and free of short circuits, ground loops, parasitic oscillations, excessive hum and noise, RF interference, or instability of any form.
- D. The Contractor shall be responsible for properly performing all setup and alignment of systems, and all assembly and setup of portable equipment.
- E. The Installer shall be responsible for properly performing the equalization of the sound system. After equalization and test the sound system shall meet or exceed the following specifications:
 1. System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference, and instability of any form.
 2. Maximum SPL with band-limited pink noise input to the system shall be 99dB before audible distortion occurs.
 3. Acoustic response of the system shall be plus or minus 1.5dB along a line which is flat from 80Hz to 4000Hz and which rolls off at 1dB per octave to 16kHz.

3.5 FIELD QUALITY CONTROL

- A. The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.
- B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed. This document MUST list either the extension number, port number, or some other means so the owner will be able to look at the location of a speaker and cross reference it's number/port on this list as to be able to make programming bell/zone type changes.
- C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.6 SYSTEM COMMISSIONING

- A. Commissioning
 - 1. In the presence of the Owner's Representative the Contractor shall perform the attached functions listed below:
 - a. Check calculated Sound Pressure Levels (spl) readings at seating
 - b. Inspection of all terminations
 - c. Inspection of all W/P connections
 - d. Inspection of all inputs and output devices
 - e. Check wire types at all locations
 - f. Verify connector types
 - g. Verify coverage of speaker system
 - h. Contractor must provide man lift to speaker location
 - i. Contactor must provide access to all termination points
 - j. Check programming of control surface for routing and proper function
 - k. All testing documentation will be supplied as a part of the Contractors As-built Documentation.
- B. Contractor will include four (4) hours for onsite commissioning. Contractor will provide the installation technician who was responsible for this project to be present at the system commissioning to tune, fix, repair, replace all system components that do not operate within the tolerance as set forth in this specification, the project documents, and industry standards.
- C. The final acceptance of the system by the Owner will be based upon the report of the Owner representative following inspection, testing, and commissioning. A list of items in need of completion or correction shall be generated by the owner, which must be corrected by the

Installer before final acceptance will be granted.

3.7 TRAINING

- A. Contractor shall provide no less than two (2) two (2) hour training sessions.
 - 1. The first training session will be a "Train the Trainer". The owner will appoint their representative to be provided extensive training so that he/she will be able to provide additional support once the project has been completed.
 - 2. The additional training session will be provided as a general overview of the system operation for large groups or several smaller groups as designated by the owner. Usually these additional training events will coincide with a school function when the sound system will be used.
 - 3. Provide sign in sheets for all training events. Deliver to architect in the close out documents.
- B. System Training: Submit the following information describing the training programs and system trainers in accordance with the specifications.
 - 1. 1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
 - 2. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
 - 3. Include with the submittal a current copy of trainer's need's assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
 - 4. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

3.8 WARRANTY

- A. Contractor will provide a minimum of a 2-year Workmanship Warranty that includes Parts and Labor.
- B. All equipment provided under this specification shall be warranted to be free from defects in materials and workmanship for a period of 24 months from the notice of completion.
- C. The Contractor shall maintain regular service facilities and provide a qualified technician familiar with the work specified for this project. Contractor will respond to all notice of malfunction from the Owner within 24 hours of receiving trouble call. As part of this warranty, the Contractor shall provide, at no expense to the Owner, all material, devices, equipment, and personnel necessary and resolve malfunction and/or to provide alternate facilities, services, or equipment for the duration of repairs to any defective work as described in this section.
- D. All repairs and service under warranty shall be at the jobsite unless in violation of manufacturer's warranty, wherein contractor shall provide substitute equipment for the duration of repairs. Transportation of substitute or test equipment and personnel to and from the jobsite shall be at no expense to the owner.

- E. All repair and service work under warranty work, except emergency repairs can be performed during regular working hours of regular working days. Emergency repairs shall be made when a system or component malfunctions during use, and shall be performed on an immediate basis. All work shall be performed by personnel in the employ of contractor, having specific experience in the work of this specification and shall not be subcontracted or assigned to another company for service, unless Owner has approved such assignment in writing, in which event contractor shall nevertheless be responsible to the Owner for such work..

END OF SECTION 27 51 00

SECTION 27 51 13
PAGING SYSTEMS

PART 1 – GENERAL

1.1 RELATED SECTIONS

- A. Section 26 05 00 – Common Work Results for Electrical
- B. Section 27 00 00 – Communications
- C. Section 27 20 00 – Structured Cabling

1.2 REFERENCES

- A. The system shall be listed as a Power Limited Device and be listed under the standards in this section. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.
- B. California Code of Regulations
 - 1. Title 24, Part 3 – California Electrical Code
- C. National Fire Protection Association (NFPA)
 - 1. NFPA 70 – National Electric Code (NEC)
 - 2. NFPA 72 – Local Protective Signaling
 - 3. NFPA 72 – Remote Station Protective Signaling
 - 4. NFPA 72 – Proprietary Protective Signaling

1.3 SCOPE OF WORK

- A. Furnish, install, and program as shown on plans and as hereinafter specified all equipment, cabling, and terminations for a fully functional system.
- B. The contractor shall furnish complete shop drawings for review and approval.

1.4 SYSTEM DESCRIPTION

- A. The paging system shall be a highly configurable district wide system that runs on the District's wide area network (WAN) or virtual private network (VPN) by means of a single server application.
- B. The system shall be programmed, monitored, and controlled via a web based Graphical User Interface (GUI) provided by a factory designed server application running on a Microsoft Windows 2000 or 2003 server. The server to receive the application shall be designated by the District.
- C. The application shall support different levels of user privileges as designated by the paging system administrator.
- D. The GUI shall be accessible to all networked computer residing on the district's WAN or VPN. Access to the server shall be granted via login and authentication that supports the Secure Sockets Layer (SSL) / Transport Layer Security (TLS) protocol.
- E. The system shall automatically recognize all system speakers connected to the District's WAN or VPN. Paging options shall be universally configurable to include district wide all page, specific campus all page, campus zone paging, etc.

- F. The number of configurable zones shall be unlimited. A zone may be as small as one speaker or as large as all of the speakers. Each speaker may be assigned to an unlimited number of zones.
- G. In addition to live and ad hoc paging, the system shall support playback of recorded messages stored as .wav files, to include the program bell tone, daily announcements, lockdown alert, evacuation alert, etc. The system shall allow a different tone or message for each zone. The system shall also be able to broadcast messages to computer screens running a client application.
- H. The system shall support special calendar schedules to adjust for special events, holidays, etc. The system shall support multiple simultaneous schedules on the same facility (e.g., one schedule for grades 1-6, another for kindergarten, etc.) The system shall be able to automatically compensate for daylight savings time and automatically synchronize the system time with internet time servers.
- I. The system shall log all events that occur and trigger and alarm for any errors or changes (e.g. message send failure, speaker failure, new speaker connected to network, etc.).
- J. The system shall receive voice input from SIP softphones installed on designated computers. The system shall also be capable of interfacing with any analog PBX or VoIP communications system to provide paging from telephone system handsets.
- K. The system shall be capable of initiating sounding specific messages or sending text messages to designate computers as triggered by other systems (e.g., fire alarm, security, etc.) via analog to digital zone controllers.
- L. The system shall be capable of interfacing with any legacy paging system to provide paging features inherent to the legacy system.
- M. Paging system speakers shall connect to the school LAN via CAT6 data cabling and IEEE 802.11af compliant power over ethernet (POE) switches located in data distribution frames. Each speaker shall be individually addressable via dynamic host control protocol (DHCP) addressing. The number of supported speakers shall be limited only by the number of available IP addresses. Speaker operation shall be accomplished by individual amplifiers on each speaker.
- N. The system shall support synchronized digital wall clocks as an integral component of the speaker.
- O. Stand-alone clocks shall be installed and connected to the master clock. Provide master clock at each building IDF where stand-alone clocks are used.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- A. (Existing PA Rack)
- B. Sapling, Inc.
1633 Republic Road, Huntingdon Valley, PA 19006
Phone (215) 322-6063. FAX (215) 322-8498. Website: www.sapling-inc.com
- C. Atlas Sound
4545 E. Baseline Road, Phoenix, AZ 85042

Phone (800) 876-3333.
FAX (800) 765-3435.
Website: www.atlassound.com

- D. The manufacturer shall have at least twenty-five (25) years of experience in the role of public address system manufacturing, and a proven track record of forward and backward compatibility for a minimum of twenty (20) years for its product's auxiliary devices, including speakers, amplifiers, and paging equipment.

2.2 HEAD END

- A. Existing Atlas Sound #CK-K12 "ControlKom" Server Application

2.3 SPEAKERS

- A. Suspended Ceiling Mount: Atlas Sound #I128SYS
- B. Wall Mount: Atlas Sound #I8S speaker and #FEST-I8S (flush mount) or #SEST-I8S (surface mount) enclosure
- C. Exterior Vandal Resistant Speaker: Atlas Sound #IH-VP speaker and #FEST-IH (flush mount) or #SEST-IH (surface mount) enclosure
- D. Pendant Mounted Speaker: Atlas Sound #PM8FA

2.4 CLOCKS

- A. Wall Mount: Sapling wireless to match existing.

2.5 CLOCK/SPEAKER CMBO

- A. Wall Mount: Atlas Sound #I8SC speaker/clock and #FEST-I8SC (flush mount) or #SEST-I8SC (surface mount) enclosure

2.6 CLOCKS (STAND-ALONE)

- A. Wall Mount: Sapling #SBD-004-254-1 wall clock
- B. Clock Master: Sapling #SSM-100-0-1 IP synchronized master clock

2.7 IP ADDRESSIBLE ZONE INTERFACE MODULES WITH BALANCED LINE LEVEL OUTPUT (SEE SECTION 3.2, BELOW)

- A. Single Zone: Atlas Sound #IPS-ZC1
- B. Dual Zone: Atlas Sound #IPS-ZC2

2.8 AMPLIFIERS

- A. 100 Watt Rack Mounted Amplifier: Atlas Sound #PA1001G and 19" rack

2.9 EQUIPMENT COLOR

- A. Where equipment is available in different colors, the contractor shall contact the architect for the color selection.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Horizontal cabling jackets, patch cable jackets, and modular RJ-45 jacks serving the Paging System shall be green in color. All cabling shall be installed and labeled in accordance with 27 20 00.
- B. Install ControlKom software on the server designated by the district and configure per specifications.
- C. Provide (3) SIP softphones and connect to computers at locations designated by the district.

3.2 ZONE INTERFACE MODULE / AMPLIFIER APPLICATION NOTE

- A. It shall be understood that all components in this system shall be IP devices, unless specifically noted otherwise. It is not acceptable to create-a-device with a zone interface module and conventional speaker. Zone interface modules and amplifiers shall be used only where specifically called for in the plans.

END OF SECTION 27 51 13

SECTION 27 51 26
ASSISTIVE LISTENING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Transmitters.
 - 2. Receivers.
 - 3. Antenna and cabling.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Electronic Industries Association (EIA):
 - EIA REC 127-49; Power Supplies.
 - EIA RS 160-51 Sound Systems.
 - EIA SE 101-A-49; Amplifiers for Sound Equipment.
 - EIA SE 103-49; Speakers for Sound Equipment.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 50; Enclosures for Electrical Equipment.

1.3 SYSTEM DESCRIPTION

- A. Assistive listening system for the football stadium and team rooms.
- B. Digital audio processing and direct digital synthesis for superior FM transmission, sound clarity and channel flexibility; wide-band and narrow-band compatible; bass cut adjustment; line, microphone and speaker level inputs; lightweight and comfortable receivers; easy to install and operate.
- C. Include charging cases for housing portable system components.
- D. The ALS system shall be a fixed system., The transmitter shall be rack-mountable base station with input from house sound system, microphone or speaker. Must have terminal block speaker level input, flexible connection options (XLR microphone/line input), VFD display, level control, customized output, overload warning light, RF fault indicator, frequency

agility and lock out feature to prevent transmitter settings from being changed.

- E. Personal receivers shall be body-worn and furnished with pouch and belt clips. Receiver models shall be narrow-band, 72 to 76 MHz frequency with 6-channels.
- F. Range shall be 700,000 square feet of unobstructed coverage with standard antenna or higher as required to cover the entire stadium area per UBC..
- G. Personal receivers shall be body-worn and furnished with pouch and belt clips. Receiver models shall be narrow-band, 72 to 76MHz frequency with 6-channels.
- H. Range shall be 700,000 square feet of unobstructed coverage with standard antenna or higher as required to cover the entire floor area per UBC.

1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 270010: Basic Communications Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and communications characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe system operation, equipment, dimensions and indicate features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Total number of personal receivers and accessories including pouch with belt clip to be provided (minimum of 1% of the total number of seats for Stadium).
 - 5. Proposed antenna location and mounting detail.
 - 6. Local frequency usage, from frequency scanning survey with proposed frequency for this Project.
 - 7. Submit Manufacturer's installation instructions.
 - 8. Complete Bill of Materials listing all components.
 - 9. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 270010: Basic Communications Requirements, to include the following:
 - 1. A detailed explanation of the operation of the system.
 - 2. Instructions for routine maintenance.
 - 3. Pictorial parts list and part numbers.
 - 4. Schematic wiring diagrams.

5. Telephone numbers for the authorized parts and service distributor.
6. Final testing reports.

1.6 QUALITY ASSURANCE

- A. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- B. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- C. The installation contractor shall be licensed and bonded contractor holding a valid Electrical Contractor's License (C-7) as prescribed by State of California.
- D. The installation contractor shall be in business for a minimum of 7-years and have had experience with seven or more installation of Assistive Listening Systems of comparable type and size, as specified in the drawings and specifications. Each of these installations shall have performed satisfactorily for at least 2-years in operation after final acceptance by the user.
- E. The installation contractor shall maintain a fully staffed and equipped service facility, as well as have trained and certified journeyman level personnel for the products specified.
- F. Installation Contractor's Engineers and Technicians shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Assistive listening system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipping shall be replaced and returned to Manufacturer at no cost to Owner. Components shall be properly packaged in factory-fabricated containers.
- B. Storage: Store in clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal components damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

- A. A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Listen Technologies
2. Williams Sound, Corp.

B. Substitutions: Under provisions of Section 270010: Basic Communications Requirements.

2.2 FIXED TRANSMITTER (FOOTBALL STADIUM, TEAM ROOMS)

- A. The transmitter shall operate in the Auditory Assistance Band as approved by the FCC. The transmitted field strength shall not exceed 80mV per meter at three meters and transmit to an area of more than 700,000 square feet. The operating frequency shall be digitally selectable by rear panel thumb wheel switches to any of 37 frequencies in the approved band.
- B. Transmitter shall have XLR balanced and RCA unbalanced input jacks selectable as balanced mic, balanced and unbalanced line, and unbalanced speaker audio signals. Front panel control to adjust the audio input level with and LED audio level display. Switchable high-pass filter providing a 6dB/octave roll off at 180Hz. Included is an audio processing chain that consists of wide-band AGC, multi-band compression, Aphex Aural Exciter, and peak limiting. Also, front panel control to regulate the overall amount of audio processing and switchable 1kHz test tone to aid setup and receiver tuning.
- C. Transmitter shall be powered by an external AC line to 12VDC power adapter. The front panel shall have a power switch with LED and an LED to indicate proper RF carrier operation. Included shall be a 1/4" stereo monitor jack with volume control. Transmitter shall be rack mountable in a standard 1 RU rack space.
- D. Transmitter shall be supplied with remote mounted flex antenna and 50 feet of RG174 coaxial type cable.
- E. Technical specifications:
 1. Audio inputs:
 - a. Mic: 600Ω balanced, 10mV
 - b. Line: 600Ω balanced, 1V
 - c. Line: 10Ω unbalanced, 1V
 - d. Speaker: unbalanced
 2. Automatic gain control range: 40dB
 3. Manual input level control: 20dB
 4. Signal to noise ratio: 60dB
 5. Transmission type: FM modulation
 6. Max. deviation: ±25kHz, 50kHz total
 7. Max. radiated power: 8000uV/m at 30M ≤100mW
 8. RF level adjust: 1/4, 1/2 and full power

9. Frequency control: Digitally synthesized, crystal controlled
10. Frequency stability: 0.005% from 0-50°C
11. Selectable frequencies: 37 channels between 72-76MHz
12. Power requirements: 9-15VDC at 500mA

2.3 RECEIVER

- A. The receiver shall operate in the Auditory Assistance Band as approved by the FCC. It shall be digitally tunable to one of 37 frequencies within that band by concealed rotary switches.
- B. The receiver shall be housed in a high-strength, plastic case with integral pocket clip. The on/off/volume control shall be properly marked and the only control that is exposed. There shall be a standard 1/8" mono headphone jack for audio output. The jack shall be recessed to provide stress protection for the headphone plug.
- C. The receiver shall operate on two standard AA batteries, and contain built-in recharging contacts for operation with rechargeable batteries and a suitable drop-in recharger.
- D. Technical Specifications:
 1. Type: FM, medium bandwidth (60kHz)
 2. Audio frequency range: 100Hz-10kHz
 3. Audio output level: 140mW into 32Ω
 4. Signal-to-noise ratio: >55dB
 5. Distortion: <2%
 6. RF frequency range: 37 channels, 72-76MHz
 7. Sensitivity: 0.8uV typical, 1mV max for 12dB SINAD
 8. Controls: On/off/volume, channel selector (hidden)
 9. Earphone jack: Standard 3.5mm mono
 10. Power requirements: 2 x AA batteries
 11. Battery life: 40 hours with alkaline types
- E. Stadium Seating Occupancy: 6,140
 1. Home Bleachers: 4,167
 2. Visitor Bleachers: 1,973
 3. Provide a minimum 148 (148) receivers. Provide a minimum of thirty-seven (37) hearing aid compatible.
- F. Provide each receiver with earbuds and rechargeable lithium batteries.

- G. Provide charging cases for the quantity of portable receivers provided.

2.4 REMOTE ANTENNA

- A. Exterior wall mounted dipole antenna, 72 MHz and 216 MHz.
- B. Mounting to a weather proof electrical box.
- C. Typical Range
 - 1. 305M @72 MHz.
 - 2. 914M @216 MHz.

2.5 ANTENNA CABLE EXTENDER

- A. Coaxial cable:
 - 1. Cable <50': RG58A/U, Belden #8219 with 4dB loss over 100ft. or Belden #9311 with 3dB loss over 100ft.

2.6 SIGNAGE

- A. Providing ALS signage per 2019 CBC 11B-216.10

2.7 BATTERY CASES

- A. Cases shall be able to charge 4, 8, 12, or 16 portable devices and shall be sized per the number of devices per room requirements.
- B. The case shall have hard foam interior and durable steel latches.
- C. The case shall have pockets to store earphones and prevent tangling.
- D. Earphones shall be able to stay attached to receivers while storing and charging.
- E. The case shall be lockable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of the assistive listening system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

- A. General:
 - 1. Install system in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
 - 2. Carefully match input and output impedances and signal levels at signal interfaces.

Provide matching networks where required.

- B. Transmitter: Install transmitter in sound rack or on top of sound rack. Coordinate exact location with sound system Sub-contractor.
- C. Antenna and ground plane: Install antenna and ground plane on the ceiling in accordance with Manufacturer's written instructions and as indicated on the Drawings.
- D. Wiring:
 - 1. Route wiring continuously between devices without splices.
 - 2. Size wiring to conform to the equipment Manufacturer's requirements.
 - 3. All wiring shall be installed in a continuous steel conduit system and shall be of the size recommended by the equipment Supplier.
 - 4. Make splices, taps and terminations on numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures. Identification of conductors and cables: use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- E. Receivers: Deliver the receivers to the Owner after system has been installed and tested.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the system. Testing Agencies objectives shall be to:
 - 1. Assure assistive listening system installation conforms to specified requirements and operates within specified tolerances.
 - 2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 - 3. Verify settings and make final adjustments. Settings and adjustments shall be performed on the transmitters and all the receivers.
- B. Prefunctional testing:
 - 1. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all connections.
 - e. Check that all covers, barriers, and doors are secure.

2. Communications tests:

- a. Perform complete testing to determine conformance with the requirements of the Contract Documents.
- b. Operational test: Perform an operational test to verify conformance of system performance and conditions to Contract Document within Manufacturer's tolerances.
- C. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and Engineer's hourly rate.
- D. Contractor shall replace at no cost to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- E. Contractor shall submit the testing final report to the Engineer for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observations, deficiencies, and remedies. Include a copy of the test report in the Owner's operation and maintenance manuals.

3.4 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean the system components per Manufacturer's approved methods and materials. Remove all paint splatters spots, dirt, and debris.

3.5 TRAINING

- A. Factory authorized service representative shall conduct a 4-hour training seminar for Owner's representative upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment.
- B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION 27 51 26

SECTION 27 73 13
SOUND REINFORCEMENT SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Sound reinforcement/playback systems for the Football Stadium, and Varsity Training Room
 - 2. 2. Accessories.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 26.

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Electronic Industries Association (EIA):
 - EIA REC 127-49; Power Supplies.
 - EIA RS 160-51 Sound Systems.
 - EIA RS 299-A; Loudspeakers, Dynamic Magnetic Structures and Impedance.
 - EIA RS 310-A; Racks, Panels and Associated Equipment.
 - EIA SE 101-A--49; Amplifiers for Sound Equipment.
 - EIA SE 103-49; Speakers for Sound Equipment.
 - EIA SE 105-A; Microphones for Sound Equipment.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 13; Power-Limited Circuit Cables.
 - UL 50; Enclosures for Electrical Equipment.
 - UL 813; Commercial Audio Equipment.

1.3 SYSTEM DESCRIPTION

- A. This Section specifies the minimum requirements for a complete sound reinforcement system.

B. Football field sound systems:

1. 1. Sound reinforcement system shall be used for providing reinforced speech and music to all attending listeners within the bleachers of the fields. As a minimum, the system shall include automatic microphone mixer, equalizers, power amplifier, speakers, line transformers, microphones, attenuators, signal distribution system, wall jack plates, mounting and accessories necessary to satisfy the requirements of that specified herein:
2. Any equipment required to make this a complete working system, regardless of whether it is specified or not, shall be furnished and installed by the Contractor.
3. The sound system shall be a constant voltage, low volume system, with sufficient speakers to provide uniform coverage of the entire zoned area. The sound must be a low level faithful reproduction of the input source.
4. A multi-channel mixer with microphone and line level capability shall be provided.
5. Mixer outlet shall be normally connected through an audio processor for maximizing the gain before feedback within the stadium.
6. Hardwired and wireless microphones shall be provided.
7. Loudspeaker Management system
8. Microphone mixer output shall be normally connected for maximizing the gain before feedback of speech reinforcement. Line inputs will be reproduced full range without band limiting equalization.
9. Wall receptacle plates shall be provided with microphone XLR jacks as indicated on Drawings.
10. Speakers shall provide uniform coverage for speech reinforcement and for music playback.
11. Audio Bluetooth and internet radio player shall be provided.

C. Classroom A110

1. Sound reinforcement system shall be used for providing reinforced speech and music the room. As a minimum, the system shall include automatic mixer, equalizers, power amplifier, ceiling speakers, attenuators, signal distribution system, wall jack plates, mounting and accessories necessary to satisfy the requirements of that specified herein:
2. Any equipment required to make this a complete working system, regardless of whether it is specified or not, shall be furnished and installed by the Contractor.
3. The sound system shall be a constant voltage, low volume system, with sufficient speakers to provide uniform coverage of the entire space. The sound must be a low level faithful reproduction of the input source.
4. A multi-channel mixer with microphone and line level capability shall be provided.

5. Mixer outlet shall be normally connected through an audio processor for maximizing the gain before feedback within the stadium.
 6. Microphone mixer output shall be normally connected for maximizing the gain before feedback of speech reinforcement. Line inputs will be reproduced full range without band limiting equalization.
 7. Wall receptacle plates shall be provided with microphone XLR jacks as indicated on Drawings.
 8. Speakers shall provide uniform coverage for speech reinforcement and for music playback.
 9. Audio Bluetooth and internet radio player shall be provided.
 10. Remote zone audio volume control.
- D. ADA assistive listening system:
1. This system shall assist patrons with a hearing impairment to better hear the performance by means of wireless receivers.
 2. Program signal shall be normally derived from the stadium sound system. Additional signal sources may be patched as desired.
 3. Receivers shall be in the form of FM wireless headsets, which shall provide additional capability to interface to individual induction-loop and other devices to permit more direct coupling of the received signal to a patron's compatible hearing aid device.
 4. The system shall transmit the audio signal via FM antenna located on the exterior face of the press box.

1.4 SUBMITTALS

- A. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
- B. Describe system operation, equipment and dimensions and indicate features of each component.
- C. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
- D. Furnish structural calculations for equipment anchorage.
- E. Submit Manufacturer's installation instructions.
- F. Complete Bill of Materials listing all components.
- G. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance to include the following:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and part numbers.
4. Telephone numbers for the authorized parts and service distributor.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Sound Reinforcement System components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipping shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

- A. Units and components offered under this Section shall be covered by a 2 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable.
 1. Amplifiers
 - a. QSC amplifiers
 - b. Crown
 - c. Or approved equal
 2. Digital Processor
 - a. Basis Of Design: Symetrix -712

- b. Or approved equal
- 3. Wireless Microphones
 - a. Shure: GLX-D
 - b. Sennheiser: Ew135G3S
 - c. Audio Technica:
- 4. Light pole speaker supports
 - a. Polestar
 - b. Or approved equal
- 5. Loud Speakers
 - a. Atlas Loud speakers
 - b. Community Loud Speakers
 - c. Or approved equal
- 6. Assisted Listening System
 - a. Listen Technologies ALS
 - b. Williams Sound
 - c. Or approved equal
- 7. Bluetooth Internet Radio Player
 - a. Dennon
 - b. Tascam
 - c. Or approved equal
- 8. Audio Cabinet
 - a. Middle Atlantic
 - b. Or approved equal
- 9. Cable
 - a. Belden
 - b. West Penn
 - c. Or approved equal

- B. Equipment Substitutions shall be approved 10 days prior to bid date. Approval shall be obtained by submitting product data of the substitute item identifying all areas of equality to that of the specified item. Substitute equipment submittals not approved prior to bid date shall be rejected.

2.2 EQUIPMENT

A. Field Speakers: AtlasIED or approved equal

1. Loudspeaker shall be Atlas Sound model FS12T-99 or approved equal. The loudspeaker system shall be a two-way, full-range design with an IP45 rating. It shall include a 12" cast frame LF woofer and an integral, concentrically mounted 1" exit compression driver coupled to a constant directivity high frequency waveguide. The three pole (18dB/octave) dividing network shall have a crossover frequency of 1.6kHz. The dividing network shall include a poly switch protection circuit for the highfrequency component.
2. The loudspeaker system shall be capable of providing a sound dispersion angle of 90° horizontal by 90° vertical in the 2kHz octave band. Rated power shall be 400 watts RMS based on EIA Standard RS-426B.
3. Enclosure shall be UV-resistant, linear low-density polyethylene (LLDPE) and shall include a 2-stage multiple mesh filter system for weather and rodent resistance: to include a 20-gauge perforated aluminum screen on front mouth assembly, a 100 x 100 weave stainless steel mesh between HF horn and HF driver and a 100 x 100 weave stainless steel mesh over 12" woofer. The loudspeaker shall include a stamped and formed, 6mm stainless steel powder coated mounting bracket assembly for surface mounting.
4. Sensitivity shall be 102.5dB SPL (80Hz to 15kHz in 1/3 octave bands) measured at a distance of one meter on axis with a one-watt input half space (2.83V). Overall frequency response shall be 80Hz – 17.6kHz. The input section located on the bottom rear of the loudspeaker shall be via 7 position screw down terminal strip internally configured to allow input to an internally mounted 70.7V transformer with 50, 100, 200, 400-watt taps and a bypass jumper direct coupled to the speaker for nominal 4 Ω operation. The system connections shall be protected from the elements by a screw affixed weather resistant cover.

B. Classroom Speakers

1. The loudspeaker system shall be AtlasIED FAP63T-W. System shall include a high performance 6.5" coaxial loudspeaker, ported bass reflex enclosure and press-fit grille for conventional ceiling installation. Frequency response for the system shall be 50Hz – 20kHz. Sensitivity shall be 90dB.
2. Loudspeaker shall be comprised of a 6.5" cone type driver. Cone shall be constructed of composite cone with polymer coated cloth surround. Magnet shall be a minimum of 10 oz (264 g) and the voice coil diameter shall be 1" (25 mm). The silk dome tweeter is 20mm and utilizes a Neodymium magnet. Transformer shall be a 70.7V / 100V type with 4, 8, 16, and 32 watt primary taps (@70.7V) with a front mounted tap selector switch to include transformer bypass setting for 8Ω direct coupled operation.

3. Enclosure shall be a deep drawn steel enclosure design. Internal volume shall be 323in³. To facilitate connection in conduit systems, enclosure shall be equipped with an access panel covering a recessed terminal cup. This cover shall provide a top access compression fitting / strain relief to facilitate flexible 1/2" conduit when the compression fitting is removed.
 4. External wiring shall be accomplished via a removable lockable wiring connector with screw-down terminals to provide both secure wire termination and pre-wiring capability before loudspeaker installation. The 4 pole locking connector shall facilitate in/out connections and shall be located in the recessed area behind the conduit access panel.
 5. Seismic support eye shall be provided on top of enclosure for additional suspension point when used in drop tile ceilings. Construction of enclosure shall be a minimum of 18-gauge deep drawn painted metal. Loudspeaker shall include Safety First Mounting System to eliminate the potential for steel screws to rust and break causing the dogleg to fail, resulting in the loudspeaker falling out of the ceiling.
 6. The system shall include a support backing plate to reinforce the ceiling material and tile support rails for use on either 2' x 4' (609mm x 1219mm) or 2' x 2' (609mm x 609mm) suspended ceiling tiles. This assembly can all be installed from beneath the ceiling tile. Overall front face diameter shall not exceed 10.51" (267 mm); overall depth from the bottom of the ceiling shall not exceed 8.86" (225.1 mm). Grilles shall be press-fit, manufactured from 24-gauge perforated steel mesh and finished in white epoxy. Round grill shall be 8.67" (220mm) diameter.
- C. Digital Signal Processor: Symetrix 761 or approved equal
1. 1. The device shall provide four inputs that are selectable as line or mic level with phantom power; there shall be eight mono-summing line inputs fitted with RCA connectors. All signal processing, mixing and routing functions (including input gains) shall be controllable via software. Audio inputs and outputs shall be accessed via rear panel RCA and 3.81 mm terminal block connectors.
 2. The Graphical User Interface (GUI) software shall be installer programmable using the Windows® XP or higher operating system. Computer connection and control shall be via the device's rear panel Ethernet connector. The GUI shall provide display and control of all signal processing and configuration functions including (but not limited to): Input and Output Gain, Highpass Filtering, Parametric Equalization, Compression, Limiting, Automatic Gain Control, Ducking, Feedback Elimination, Signal Routing, Delay, Polarity.
 3. The front panel shall include input and output signal level indicators as well as indicators for power, network, and ARC.
 4. External control shall include dedicated software screens as well as preset selection, I/O level control and muting using the optional ARC wall panel remote controls via industry-standard CAT5 cable with RJ45 connectors. All program memory shall be non-volatile and provide program security should power fail. The device shall provide an on board real time clock to facilitate automatic, timed changing of presets. Third-party control systems may interface over IP and RS232 using a published ASCII control protocol.
 5. Audio conversion shall be 24-bit, 48 kHz. The dynamic range of the processor shall not be lower than 110 dB A-weighted.

6. The device shall have a captive power input socket for an external 24 VDC supply. The device shall meet UL/CSA and CE safety requirements and comply with CE and FCC Part 15 emissions limits. The device shall be RoHS compliant. The chassis shall be constructed of cold rolled steel and moulded plastic, and mount into a standard 19" 1U EIA rack.
 7. The device shall be a Symetrix model Zone Mix 761.
- D. Symetrix Wall Panel.
1. 1. The modular ARC wall panel shall mount in a standard U.S. single-gang box and shall be compatible with standard Decora® faceplates.
 - a. The wall panel shall include one push-button rotary encoder, one eight-segment LED stack, and two status LED indicators;
 - b. All wall panel control shall function as the user interfaces for Symetrix DSP systems.
 - c. The wall panel shall be configured by software provided with the hosting device to assign control within DSP system components. RS-485 communications shall be utilized for software control and configuration.
 2. The wall panel shall be CSA tested to UL 60065. The wall panel shall be an ARC-K1e.
- E. Internet Radio and Media Player with Bluetooth: Denon DN-350UI or equal
1. Main Features
 - a. Internet radio and FM Tuner
 - b. Network ready
 - c. Bluetooth connectivity
 - d. Balanced XLR3 and Unbalanced RCA Output connectors
 - e. 1U EIA rack-mount size
- F. F. Wireless Mic System:
1. 1. The digital wireless system shall operate in the VHF 174-216MHz, UHF TV band 470-932 MHz, ISM band 902-928 MHz, 1.5G band 1492-1525 MHz, and 1.8G band 1785-1805 MHz with the specific range being dependent on the user's geographic location.
 2. The system shall include the option of changing the operating frequency in order to avoid RF interference. Preconfigured group, channel and frequency setups shall be available to ensure that multiple systems in use do not interfere with one another.
 3. All transmitters shall be powered by either a Shure SB900 or SB900A Lithium Ion Battery and shall have a power on/off switch. When operated with the Shure SB900 or SB900A Battery the system shall display remaining run time in hours and minutes (accurate to within 15 minutes).

4. Available transmitters shall include:
 - a. A handheld microphone for vocals.
 5. The transmitter front end shall optimize itself for standard inputs without requiring transmitter gain adjustments thus allowing all gain changes to be made at the receiver, which provides a 60dB range of system gain.
 6. Overall system signal to noise ratio shall be >120dB.
 7. The system shall be capable of AES-256 encryption that is conforming to the US Government National Institute of Standards and Technology (NIST) publication FIPS-197.
 8. The system shall use technology such as Shure's advanced digital predictive diversity to optimize RF stability.
 9. The receiver shall include an RF level meter, an audio level meter, and a Networking Interface connector for computer control and monitoring.
 10. The system shall be the Shure QLXD24R/SM58
 - a. Hand held Microphone: SM58
 - b. Splitter Kit: UA221
- G. Remote Wireless Antenna
1. Remote A and B wireless antennas shall be located within 25 feet of the receiver.
 - a. Winegard FlatWave Air (470-698 MHz range)
 - b. +5Vdc Power Inserter
 - c. RG-6 Cable (75 Ohm):
 - 1) Power Inserter to Antenna (F Connectors)
 - 2) Power Inserter, PI (F Connector) to UA221 Splitter (BNC Connectors)
 - 3) UA 221 Splitter (BNC) to Receiver (BNC)
- H. Portable equipment racks – Atlas IED or approved equal.
1. Portable Cabinet – Portable cabinet shall be a fully enclosed metal cabinet to secure rack mount equipment. Cabinet shall include casters and locking front and rear doors. Cabinet shall:
 - a. Be (12RU) High opening for equipment mounting.
 - b. Be 25½" deep with 19" wide E.I.A. rack rails for mounting equipment.
 - c. Include road handles on each side of the cabinet.

- d. Provide perforated top and rear flanges on cabinet and rear door for heat dissipation.
 - e. Be 16-gauge welded metal frame with 12-gauge adjustable rack rails.
 - f. Include Front and Rear locking doors capable of right or left hand mounting
 - g. Include three wire isolation holes located on bottom rear of cabinet for external wiring.
 - h. Provide Optional rear mounting rails (RR14)
 - i. Manufacturer Atlas #RX14-25
- I. Power Amplifiers – QSC GXD4 or Approved Equal
- 1. 1500W per channel at 8 ohms dynamic
 - 2. 800W per channel at 8 ohms continuous, both channels driven.
 - 3. Distortion: <1% THD
 - 4. S/N: 100dB
 - 5. Input Sensitivity: 1.2Vrms, 3.9Vrms
 - 6. Output Circuitry: Class D
 - 7. Frequency Response: +0.7 dB, -0.8 dB
 - 8. Damping Factor: (8 ohms): 100
 - 9. DSP Function:
 - a. High-pass filter, 4th-order Linkwitz-Riley, adjustable frequency 20 Hz to 4 kHz Low-pass filter, 4th-order Linkwitz-Riley, adjustable frequency 60 Hz to 4 kHz, 4-bandparametric EQ with variable frequency, gain, and bandwidth Peak limiter with power, aggressiveness, and impedance selection Delay 50 msec max.
- J. Microphone, Speaker Jacks and Interface connectors
- 1. Receptacles shall be ProCo and or FSR of proper configuration mounted in a wall outlet or as indicated on the plans with stainless steel plate as indicated on the plans.
 - 2. Field Jacks
- K. Power Sequencer
- 1. 1. Minimum Requirements:
 - a. 20A Power Conditioner & Sequencer

- b. 9 - 20A Outlets
 - c. 6 - Rear Panel Outlets sequenced in 3 stages
 - d. 2 – Front Panel Unswitched Outlets
 - e. Sequenced Output Trigger
 - f. RFI and EMI Filters
 - g. Dual Clamping Spike and Surge Suppression, DCS Circuitry
 - h. Emergency Power Down
 - i. Extreme Voltage Shutdown
 - j. External Switch Sequence Trigger Activation, Momentary or Latching Switch
 - k. External DCV Sequence Trigger Activation 5-24VDC
 - l. Circuit Breaker Protection @ 20 Amps Indicated by “Breaker Open” Indicator
 - m. AC Fault, Wiring Fault, and Abnormal Voltage Indicators
 - n. Dual Front Panel USB Charge Ports for Charging USB Devices or Gooseneck Style
- Lamps
- o. Rear Panel XLR Receptacle for the Optional AP-GNL Gooseneck Lamp
 - p. Front Panel Mains Power Switch Security Cover
 - q. AC Power Cord Retainer
- 2. 2. Manufacturer: Atlas Sound #ECS-204 or approved equal
- L. L. Speaker Cable
- 1. 12 Gauge Speaker cable: Belden #8812 or equal
 - 2. 18 Gauge Shielded Indoor Ceiling speakers: West Penn #77293 or equal
 - 3. 22 Gauge Indoor Microphone cable: West Penn #77293 or equal
 - 4. 20 Gauge Exterior Microphone cable: Belden or equal
 - 5. Mic Antenna RG6 Cable: West Penn #AQC841 or equal

PART 3 EXECUTION

3.1 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of sound

reinforcement system installation to verify conformance with Manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. General:

1. Install sound reinforcement system as indicated on Drawings and in accordance with Manufacturer's instructions.
2. Coordinate connection of school communication system with sound reinforcement system for override capability.
3. Provide grounding of sound reinforcement system and cabling.
4. Anchor and brace equipment to with stand seismic forces as calculated per OSHPD OPM, Press Box Structural Load Calculations and Musco Light Pole Load calculations.

B. Cable Installation:

1. All cabling shall be installed in a continuous steel raceway system and shall be sized as indicated on the E and T series drawings.
2. Route wiring continuous between devices without splices.
3. Cables shall be installed to avoid sharp bends or physical distortion.
4. Terminate all cables with specified connectors.
5. All audio circuit wiring external to the equipment cabinets shall provide for the shields to insulated from ground and other audio circuits. The shields shall be grounded at the point of lowest audio level only and shall be free of any other ground for their entire length. Where two cables join or connect together on a terminal strip, the shield shall be insulated from all other conductors and connected together in a manner similar to the cable conductors.
6. All cables entering a terminal cabinet shall be identified with Brady or E-Z code wire markers. There shall be no splices between terminal points.
7. Upon completion, each line shall be tested for continuity, total resistance and free of interference pickup and free of grounds, opens and shorts. Each piece of equipment shall be tested under all normal and extreme conditions of function. All speakers shall be double checked for proper angles of coverage.
8. Wire shall be numbered and tagged at both ends and be indicated on the Record Drawings (this includes all spares).

C. Cabinet Installation

1. Install wall-mount pivoting equipment racks in accordance with manufacturer's instructions at locations indicated on the Drawings.
2. Install wall-mount pivoting equipment racks plumb, level, square, and secure.

3. Mount racks for right-hand swing.
4. Adjusting
 - a. Adjust operating hardware to operate smoothly without binding.
 - b. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
5. Protection
 - a. Protect installed wall-mount pivoting equipment racks from damage during construction.

3.3 FIELD QUALITY CONTROL

- A. Pretesting: Upon completing system installation, align and adjust the system and perform complete pretesting to determine conformance with the requirements of the Contract Documents. Correct any deficiencies observed in the pretesting. Replace all malfunctioning or damaged items and retest until satisfactory results are achieved. Perform necessary adjustments and balancing of all signals and level controls to ensure proper system operation.
- B. Optimize the audio processor with a laptop to per the manufacturers instructions. Configure routing, level balancing, graphic EQ, crossover settings, feedback suppression, speaker tunings, filters, delays and other items located within the audio processor system.
- C. Connect the processor to the network.
 1. 1. The system shall have remote access from the owners PC, Laptop or I-Pad to make adjustments as necessary across the network. Coordinate with the owner's representative.
- D. Visual and mechanical inspection:
 1. Inspect for physical damage, defects alignment and fit.
 2. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 3. Check tightness of all connections.
- E. Tests:
 1. 1. Operational test: Perform an operational test to verify system is free from hum, noise and oscillations and conformance of system performance and conditions to Contract Document within Manufacturer's tolerances.
 2. Final Test and Setup: Perform a final configuration of the system during a live football event. The event will occur in the early fall at the first home game. All parameters of the system shall be reviewed and fine-tuned with a laptop during the entire event for optimum audio output. Coordinate a time with the owner's representative.
- F. If the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and Engineer's hourly rate.

- G. Contractor shall replace at no cost to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- H. Contractor shall submit the testing final report to the Engineer for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observations, deficiencies and remedies. Include a copy of the test report in the Owner's operation and maintenance manuals.

END OF SECTION 27 73 13

SECTION 28 00 00
ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 01 33 00 – Submittal Procedures
- B. Section 26 00 00 – Electrical
- C. Section 27 20 00 – Data Communications

1.2 SCOPE

- A. This section provides the minimum requirements for Electronic Safety and Security Systems. Additional requirements are to be found in subsections of this specification.

1.3 SUBMITTALS

- A. A. General Requirements
 - 1. All submittals shall be made in accordance with section 01 33 00.
- B. Licensure
 - 1. Submit proof of possession of a valid C-7 California State Contractor's License in good standing.
- C. System Submittals and Shop Drawings
 - 1. Submit a complete list of equipment and materials proposed for the system with catalog cuts, technical data, manufacturer's Specifications and detail drawings.
 - 2. Submit a complete set of detailed, scaled Shop Drawings of all racks, cabinets, and equipment, with all designations, dimensions, color, controls, wiring, and schematic diagrams of all circuits. Show interfaces to all equipment furnished, including equipment furnished by other contractors, identifying numbers of wires, termination requirements, voltages and other pertinent details. Include front elevations, cabinet dimensions, types of mounting, door barriers, catalog number of locks and finishes of terminal cabinets.
- D. Spare Parts Data
 - 1. After shop drawings are approved, and not later than thirty (30) calendar days prior to the date of beneficial occupancy, a list of spare parts data for each item of specified materials and equipment shall be submitted. The data shall include a complete list of parts and supplies with current unit prices and source of supply.
- E. Operating and Maintenance Documents
 - 1. The contractor shall furnish to the architect (3) copies of operating and maintenance instructions.
 - 2. Documentation shall outline the step-by-step procedures required for system start-up, operation, and shutdown.
 - 3. Documentation shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides.
 - 4. Documentation shall be submitted at least thirty (30) calendar days prior to acceptance test. The instructions shall include the manufacturer's name, system

model number, service manual, parts list, and a description of all equipment and their basic operating features.

- F. Warranty
 - 1. A copy of the manufacturer's warranty for all equipment and materials shall be provided.
- G. Close-Out Documents
 - 1. Upon completion of the installation, the contractor shall provide four copies (one hard copy and three electronic copies) of Project Close-Out Documents to the District. Documentation shall include the items detailed below.
 - 2. As-Built Drawings
 - The contractor shall provide a complete set of as-built drawings for the entire system upon installation completion.
 - These drawings shall include, but not be limited to, the exact locations of all equipment, connections between all equipment, and wiring for all equipment as the system is installed.
 - printout of configuration
 - 3. All System source codes and passwords (Crestron Programs) must be handed over to, and become property of the District upon completion of this project.
- H. All submittals called for shall be instruments of the Contractor, even though they may have been prepared by a subcontractor, supplier, dealer, manufacturer, or by any other person, firm or organization. Prior to submission, the Contractor shall undertake its own review and stamp with its acceptance prior to submittal.

1.4 SCOPE OF WORK

- A. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required to accomplish work indicated or specified in this or other sections, it shall be the responsibility of the Contractor to provide all materials and equipment which is usually furnished with such systems in order to complete the installation, whether or not specifically mentioned herein.

1.5 APPROVAL

- A. Installation of the system shall not commence until all approvals are granted by the Division of the State Architect (DSA).
- B. Installation of the system shall not commence until all shop drawings and submittals are approved by the School District, Architect of Record, and Engineer of Record.

1.6 QUALITY ASSURANCE

- A. Contractor Qualifications
 - 1. Must hold a valid State of California C-7 license in good standing;
 - 2. Must have completed at least three (3) projects of equal scope within the last three (3) years;
 - 3. Must maintain a service office within 50 miles of the project;
 - 4. Must be bonded to assure performance and satisfactory service during the guarantee period;
 - 5. Contractor must be registered with BICSI and have at least one RCDD on staff;
 - 6. Must have personnel fluent in the use of Computer Aided Design and possess and operate CAD software using .DWG or .DXF format.

- B. All equipment and wiring shall be furnished and installed by the authorized factory distributor of the equipment. The manufacturer's representative of each system shall provide a letter from the manufacturer of all major equipment with submittals stating that he is the representative and that the manufacturer will have a service representative assigned to this area for the life of the equipment.
- C. The Contractor shall furnish a letter from the manufacturer of the equipment specified, which certifies that the equipment has been installed according to factory recommended practices and that the system is operating satisfactorily.
- D. The Contractor shall provide not less than sixteen (16) hours of instruction to personnel in the operation, programming, and maintenance of each system. This instruction time shall be divided up as directed by the District.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials from damage during handling and installation.

1.8 COORDINATION

- A. Coordinate the Work of this section with the Work of other sections, including sprinkler systems, fire alarm systems, HVAC systems, security systems, etc., as applicable.

1.9 WARRANTY

- A. The entire system shall be guaranteed free of mechanical or electrical defects for a period of one year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District. Guarantee period shall begin from the date of final acceptance by the District.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. References to manufacturer's model numbers and other information is intended to establish minimum standards of performance, function, and quality. Equivalent equipment from the specified manufacturer's may be substituted for the specified equipment, as long as the minimum standards are met.
- B. Certain equipment will be specified "No Substitution". Central Unified School District will require these items in accordance with California Public Contract Code Division 2, Part 1, Chapter 3, Article 5, Section 3400(b)(2), in order to match centrally located facilities software and hardware, and to reduce the number of different types of parts required for repair and expansion.

PART 3 EXECUTION

3.1 GENERAL

- A. All Work described in this specifying documents and on the Project drawings shall be performed in accordance with the acknowledged Professional and industry standards and practices. All installed equipment shall meet or exceed the specified manufactures regulations.
- B. Materials shall be installed in strict compliance with all local, state, county, province, district, federal and other applicable building, safety, and fire standards, laws, codes, regulations, and guidelines including, but not limited to, all appendices and amendments and the requirements of the local authority having jurisdiction (AHJ).
- C. Examine areas and surfaces to receive each system.
 - 1. Notify Architect of conditions that would adversely affect installation or subsequent use.
 - 2. Do not begin installation until unacceptable conditions are corrected.
- D. The Contractor shall maintain a competent Supervisor and Manufacturer Certified Technicians assigned to this installation for the duration of the Project.
- E. Furnish and install all materials, devices, components and equipment required for a complete and operational system.
- F. It is the Contractor's responsibility and obligation to coordinate with all necessary trades to ensure that the integrity of and compliance with Manufacturer and industry standards are met during the duration of the installation.

3.2 INSTALLATION

- A. Furnish control panels, components, devices, cabinetry, wire, connectors, materials, parts, equipment, labor, etc. necessary for the complete installation of the systems in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.
- B. Coordinate the required space in Data equipment frames with this and other network based Communications systems that may share rack space. Provide racks with sufficient space to accommodate patch panels, switches, power supplies, etc. for all network interfaced systems.
- C. Installations shall follow standard wiring and installation practice, and shall meet or exceed industry standards of such work.
- D. Wire not installed in equipment racks, not portable, in unrated ceiling space, or not installed in conduit shall be fire rated and meet all applicable codes.
- E. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer, CEC, and NEC.
- F. Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three. All equipment shall be installed so as to provide reasonable safety to the operator. Supply adequate ventilation for all enclosed equipment items which produce heat.
- G. Furnish each system to facilitate expansion and servicing using modular, solid-state

components. All equipment shall be designed and rated for continuous operation and shall be UL listed, or manufactured to UL standards.

- H. Shields of audio cables shall be grounded at one end only, at the input side of all equipment items in the system.
- I. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to insure that constant polarity is maintained.
- J. Route cables and wiring within equipment racks and cabinetry according to function, separating wires of different signal levels (data, fire alarm SLC, fire alarm NAC, speaker, intrusion, etc.) by as much physical distances possible. Neatly arrange and bundle all cables loosely with Velcro cable ties. Cables and wires shall be continuous lengths without splices.
- K. All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.
- L. Mechanical connections shall be made using approved connectors of the correct size and type for the connection. Wire nuts will not be accepted.
- M. Label all wires in racks and console as to destination and purpose. Clearly and permanently label all jacks, controls, and connections. All labeling shall be completed prior to final system inspection.

3.3 3.3 PROGRAMMING

- A. Contractor shall provide all necessary programming to provide complete operating systems.
- B. Contractor shall include in their bid one (1) four (4) hour planning meeting with the District and their Representatives for each system to outline all specific programming issues for each system, as well as, but limited to:
 - 1. Contractor will be informed of any specific requirements for use of the system.
 - 2. Contractor will provide overview of system capabilities.
 - 3. Contractor will address all concerns of the District and their Representatives.
- C. Contractor shall include in their bid one (1) four (4) hour planning meeting with the District and their Representatives for each system, scheduled at least six (6) months after job final, to review the system performance and modify programming as needed. Programming modifications shall be provided at no cost to the District.

3.4 TESTING

- A. Completed systems shall be physically inspected by the District's representative to assure that all equipment is installed in a neat and professional manner and in accordance with these Specifications.
- B. Final systems testing and commissioning shall be performed after all installation and initial testing has been completed by the Installer, but prior to any use of the systems.
- C. The Contractor, prior to requesting systems testing and demonstration to the District's representative, shall ensure that all systems are in first-class working condition and free of

shorts, ground faults/loops, parasitic oscillations excessive hum and noise, RF interference, or instability of any form.

- D. The Contractor shall be responsible for properly performing all setup and alignment of the systems, and all assembly and setup of portable equipment.

3.5 COMMISSIONING

- A. All testing documentation shall be supplied with the as-built documentation.
- B. The Contractor will include in their bid price six (6) hours for onsite commissioning and will provide the installation technician who was responsible for this project to be present at the system commissioning to tune, fix, repair, and/or replace all system components that do not operate within the tolerance as set forth in the specifications, project documents, and industry standards.
- C. The final acceptance of the system by the District will be based upon the report of its representative following inspection, testing, and commissioning. A list of items in need of completion or correction shall be generated the District, which must be corrected by the Installer before final acceptance will be granted.

END OF SECTION 28 00 00

SECTION 28 16 00
INTRUSION DETECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 26 05 00 – Common Work Results for Electrical
- B. Section 27 20 00 – Data Communications
- C. Section 28 00 00 – Electronic Safety and Security

1.2 REFERENCES

- A. The system shall be listed as a Power Limited Device and be listed under the standards in this section. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.
- B. Underwriters Laboratories (UL):
 - 1. UL 365 Police Connect Burglar
 - 2. UL 609 Local Burglar
 - 3. UL 1023 Household Burglar Alarm System Units
 - 4. UL 1076 Proprietary Burglar
 - 5. UL 1610 Central Station Burglar Alarm Units
 - 6. UL 1635 Digital Burglar Alarm Communicator System Units
 - 7. UL 864 Control Units for Fire Protective Signaling Systems
 - 8. UL 985 Household Fire Warning
 - 9. UL 294 Access Control System Units
- C. California Code of Regulations
 - 1. Title 24, Part 3 – California Electrical Code
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 70 National Electric Code (NEC)
 - 2. NFPA 72 Local Protective Signaling
 - 3. NFPA 72 Remote Station Protective Signaling
 - 4. NFPA 72 Proprietary Protective Signaling
 - 5. NFPA 72 Household Fire Warning
- E. U.S. Government Standards / Listings
 - 1. DCID 6/9
 - 2. DoD/NIST SCIF Standards

1.3 SCOPE OF WORK

- A. Furnish and install a complete Intrusion Detection / Access Control system with the performance criteria detailed in this specification.
- B. This specification document provides the requirements for the installation, programming, and configuration of a complete Command Processor Panel. This system shall include, but not be limited to:
 - 1. Control panel

2. System cabinet
3. Power supply
4. Keypad bus
5. Batteries
6. Wiring
7. Conduit
8. Associated peripheral devices

1.4 SYSTEM DESCRIPTION

A. General:

1. The system areas and zones shall be programmable, and the system shall store, log, display, and transmit specific custom designations for system areas, zones, and user names.
2. To ensure continued, one-call support, the system shall be constructed of sensing components provided directly by the system manufacturer, such as power supplies, motion detectors, door and window position switches, glass break detectors, or other sensing devices that the manufacturer offers.
3. The system controller, user interfaces, zone input devices, relay output devices, and the system signal receiving equipment shall be engineered, manufactured, assembled, and must be distributed from a location within the United States of America.
4. The system shall support user interaction by way of a keypad, web browser, system software, key switch, or radio frequency wireless control, using integrated or auxiliary devices provided by the system manufacturer.
5. The system shall support controller zone input connections, system keypads, system zone expansion modules, and wireless zone input modules, and must support zone input connections by way of at least two competitive products. The system shall offer a seamless integrated compatibility with hard-wire and/ or wireless zone expansion equipment for at least 200 wireless zones and/ or a maximum of 574 hardwired zones.
6. The system shall be capable of offering at least five zone expansion buses, each of which can support the connection of up to 15,000 feet of four-wire cable. Zone expansion and keypad data buses that exceed 2,500 feet of cable must include splitter/repeater modules to boost data voltage and maintain data integrity.
7. The system shall provide a seamless capability to provide a minimum of 500 addressable relays, which can be located at any connection location upon a zone expansion bus.
8. System relay outputs shall have the capability of being triggered as a result of a command from the user interface, changes in system status, changes in zone status, or by a programmable schedule.
9. System relay output states shall be programmable for momentary, maintained, pulsed, or must follow the state of an associated system zone input.
10. The system shall be completely programmable either locally from a keypad or remotely through a standard dial-up, and network connections by way of a LAN, WAN, and/or by way of the Internet.
11. The control unit shall be completely programmable remotely using remote annunciators, and/ or using upload/ download software that communicates using SDLC 300 baud, 2400 baud, or IP Addressed data network. On-site programming from a personal computer shall also be permitted.
12. The control unit shall be equipped with an anti-reversing circuit breaker to prevent damage due to accidental reversal of battery leads.
13. The master control unit shall be connected to expansion modules via fiber optic cables and transceivers on the data network. There will be no separate copper cable runs across the site for the intrusion system.

- B. Input/Output Capacity:
1. This system shall be capable of monitoring a maximum of 574 individual zones and controlling a maximum of 502 output relays.
 2. The control panel shall have, as an integral part of the assembly, 2 SPDT Form C relays rated at 1 Amp at 30 VDC and four open collector 12 VDC outputs rated at 50mA each. It shall also have the capacity of a maximum of 125 output expander modules with 500 switched ground, open collector outputs, 50mA maximum and 502 auxiliary relays (Form C rated at 1.0 Amp at 30 VDC).
 3. The panel shall also provide 100 programmable output schedules, and include an integral bell alarm circuit providing at least 1.5 Amps of steady, pulsed, or temporal bell output. Output type shall be programmable by zone type. Relays and voltage outputs shall be capable of being independently programmed to turn on and/or off at selected times each day.
- C. User/Authorization Level Capacity:
1. The system shall be capable of operation by 10,000 unique Personal Identification Number (PIN) codes with each code having one (1) of ninety-nine (99) custom user profiles. This allows for limitation of certain functions to authorized users. The operation of all keypads shall be limited to authorized users.
- D. Key pads:
1. The system shall support a maximum of sixteen (16) keypads with alphanumeric display. Each keypad shall be capable of arming and disarming any system area based on a pass code or Proximity key authorization. The keypad alphanumeric display shall provide complete prompt messages during all stages of operation and system programming and display all relevant operating and test data.
 2. Communication between the control panel and all keypads and zone expanders shall be multiplexed over a non-shielded multi-conductor cable, as recommended by the manufacturer. This cable shall also provide the power to all keypads, zone expanders, output expanders, and other power consuming detection devices.
 3. If at any time a keypad does not detect polling, the alphanumeric display shall indicate "SYSTEM TROUBLE". If at any time two devices are programmed for the same address, the alphanumeric keypad shall display "4 WIRE BUS TROUBLE". If at any time a keypad detects polling but not for its particular address, the alphanumeric display shall indicate "NON POLLED ADDR". The system shall display all system troubles at selected keypads with distinct alphanumeric messages.
 4. The keypad shall include self-test diagnostics enabling the installer to test all keypad functions: display test, key test, zone test, LED test, relay test, tone test, and address test.
 5. The keypad shall provide an easy-to-read English text display. The text shall exactly match the text seen in all software reports, keypad displays, and central station reports.
 6. The keypad user interface shall be a simple-to-use, menu-driven help system that is completely user friendly.
 7. The control panel shall support a keypad interface accessible on the World Wide Web in a browser window. The web-accessible keypad interface shall provide at least five (5) programmable hyperlinks for camera access or other use.
 8. The system shall support sub-control keypads with four (4) built-in zones and capable of functioning in the following modes:
 - a. Panel monitors all four (4) keypad zones independently with a maximum of 125 keypads attached to the control panel
 - b. Panel assigns one (1) zone to each keypad and monitors all keypad zones as a single zone with a maximum of 500 keypads attached to the control panel
 - c. Stand-alone mode allowing keypad to operate as a self-contained

security system independent of the control panel

E. Zone Configuration:

1. A minimum of 4 Class B ungrounded zones shall be available at each keypad or zone expander on the system. The system shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders or 500 single zone expanders. It shall also have the capacity of a maximum of 125 supervised relay output expanders. All Class B zones shall be 2-wire, 22 AWG minimum, supervised by an end-of-line (EOL) device and shall be able to detect open and short conditions in excess of 500ms duration.
2. Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority, and Key Switch Arming.
3. The keypad bus shall be able to operate at a maximum wiring distance of 2500 feet from the control panel on unshielded, non-twisted cable. This distance may be extended to a total of 15,000 feet when bus repeater modules are installed.
4. The system shall have the capability to incorporate up to 200 zone expander POPIT™ points.
5. Each zone shall function in any of the following configurations:

Night	Supervisory	Auxiliary 1	Cross-Zone
Day	Emergency	Auxiliary 2	Priority
Exit	Panic	Fire Verification	Arming
Fire			

F. Communication:

1. The system shall be capable of signaling to as many as 8 remote monitoring station receivers. Seven (7) of the eight (8) paths shall be capable of being assigned as either a "primary" or "backup" path. In such a manor the system shall have multiple primary paths to multiple remote monitoring stations as well as multiple backup paths to multiple monitoring stations.
2. The system shall be capable of signaling to two remote monitoring station receivers, four telephone numbers of 32 digits each using two separate switched telephone network lines such that if two unsuccessful attempts are made on the first line to the first number, the system shall make two attempts on first line to the second number. If these two attempts are unsuccessful, the system shall make two further attempts on the first line of the first number. After the tenth unsuccessful attempt, dialing shall stop and the alphanumeric keypad shall display trouble. Should another event occur that requires a report to be transmitted, the dialing sequence shall be repeated. The system shall have a programmable option to dial a second set of telephone numbers after the first ten attempts using the same sequence.
3. The system shall be capable of communication using the IBM Synchronous Data Link Control format, and at least two other standard industry formats.
4. The system shall be capable of supporting Network communication with digital dialer backup, existing Ethernet data networks, satellite communication, fiber optic networks, local area networks, wide area networks, cellular communication, and retail data networks.

G. Network Communication:

1. The control panel shall be capable of asynchronous network communication with a retry time between 3 and 15 seconds for a total of one (1) minute. If communication is unsuccessful the control panel shall be capable of attempting backup communication through any of the available communication methods to the same receiver or a backup receiver.
2. The control panel shall employee adaptive communication technology. Adaptive

Technology allows a Backup communication path programmed to use Network or Cellular to automatically ADAPT to the faster check-in rate of the Primary path should the Primary path become unavailable, creating a seamless transition for communication of messages. Select Adapt when programming the Checkin option. This allows a system to be fully supervised even if a path fails, while also keeping wireless charges low when the network is good.

3. Network communication between the control panel and the receiver shall be in a proprietary communication format.
 4. The control panel shall be capable of supporting Dynamic Host Communication Protocol (DHCP) Internet Protocol (IP) addressing.
 5. Underwriters Laboratories (UL) shall list network communication by the control panel for Grade AA High-Line Security.
 6. The control panel shall be capable of two-way network communication using standard Ethernet 10BaseT in a LAN, WAN, or Internet configuration.
 7. The control panel shall be capable of communication by means of a 128 Bit AES Rijndael Encryption process certified by NIST (National Institute of Standards and Technology) to an SCS-1R receiver with a built-in Encryption Alarm Router.
 8. The control panel shall be capable of meeting DCID 6/9 and UL 2050 standards.
- H. TCP/IP Network Trapping:
1. The control panel shall be capable of having communication set to Network operation. When a trap is set in Remote Link, the software shall be capable of sending a panel trap message with the panel account number to the SCS-101 installed in an SCS-1R receiver.
 2. The receiver SCS-101 shall store the trap and monitor the panel for the next message. When the panel sends its next message, the receiver SCS-101 shall then send a message to the panel to contact Remote Link at the IP address contained in the original trap message.
 3. The trap message shall be stored in the receiver SCS-101 for up to four hours. If the trap message is not sent to the panel within the four-hour window, the panel trap message shall be discarded and a new trap message must be sent from Remote Link.
 4. The user shall be able to view the trap status in the receiver SCS-101 in Remote Link using the Trap Query function.

1.5 SUBMITTALS

- A. Licensure
1. Submit proof of possession of a valid California Alarm Company Operator's License in good standing with the California Bureau of Security and Investigative Services.

PART 2 PRODUCTS

2.1 2.1 MANUFACTURER

- A. Digital Monitoring Products, Incorporated (DMP)
2500 N. Partnership Boulevard, Springfield, MO 65803
Phone (417) 831-9362. FAX (417) 831-1325. Website: www.dmp.com
- B. The manufacturer shall have at least twenty-five (25) years of experience in the role of fire and security control manufacturing, and a proven track record of forward and backward compatibility for a minimum of twenty (20) years for its product's auxiliary devices, including system keypads, annunciation devices, zone expansion modules, and addressable detection devices.

- C. The manufacturer must also manufacture receiving equipment that is compatible with standard dial-up telephone lines and network monitoring equipment that is compatible with a LAN, WAN, and the Internet. The receiving equipment shall be capable of receiving all status and alarm messages generated by the system. The receiving equipment shall be capable of updating the panel operating program and the system date and time.

2.2 CONTROL PANEL

- A. DMP Command Processor™ Panel
 - 1. The system shall be inclusive of all necessary function, monitoring, and control capability as detailed herein and on accompanying shop drawings.

2.3 GENERAL COMPONENT REQUIREMENTS

- A. A. Component Enclosure
 - 1. Housings; power supply enclosures, terminal cabinets, control units, and other component housings, collectively referred to as enclosures shall be so formed and assembled as to be sturdy and rigid. If sheet steel is used in the fabrication of enclosures, it shall be not less than an 18 gauge door with a 20 gauge box frame. Where exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent ready removal. Doors having a latch edge length of less than 24 inches shall be provided with a single lock. Where the hinged door latch edge is 24 inches or more in length, doors shall be provided with three-point latching device with lock; or alternatively with two locks, one located near each end. For SCIF and High Security applications an attack proof enclosure with proper tamperers UL listed for use with the XR500/XR500N/XR500E shall be used.
- B. Electronic Components
 - 1. All system electronic components shall be solid-state type, mounted on printed circuit boards. Light duty relays and similar switching devices shall be solid-state type or electromechanical.
 - 2. The panel shall have an over current notification LED that lights when devices connected to the Keypad Bus and LX-Bus(es) draw more current than the panel is rated for. When the over current LED lights, the LX-Bus (es) and Keypad bus are shut down.
- C. Control Unit
 - 1. A battery test shall be automatically performed to test the integrity of the standby battery. The test shall disconnect the standby battery from the charging circuit and place a load on the battery. This test shall be performed no more than every 180 seconds.
 - 2. The control unit shall be capable of operating and supervising notification appliance devices as well as addressable initiating detection devices and an integrated supervised dual line digital communicator.
 - 3. Control unit must be "Flash ROM" updatable, and program must be held in non-volatile RAM. The panel shall be able to function while the update is in process.
 - 4. Control unit shall be capable of operating using an optional built in Encrypted Alarm Router for SCIF (Sensitive Compartmented Information Facility) applications that is certified by NIST (National Institute of Standards and Technology) for 128 Bit AES Rijndael Encryption communications.
 - 5. The optional built-in Encrypted Alarm Router shall be capable of compliance with DCID 6/9 and UL 2050 standards.
- D. Remote Annunciators
 - 1. The system shall support a maximum of sixteen (16) supervised remote annunciators

- with the identical capabilities, functions and display layout. Operation of the remote annunciators shall be limited to authorized users by the use of a code or key.
2. The remote annunciators shall be capable of operating at a maximum wiring distance of 15,000 feet from the control unit on unshielded, non-twisted cable.
- E. Control Designations
1. Controls shall be provided to ensure ease of operation of all specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals and indicating devices, input and output connectors, terminals and test points shall be clearly marked or labeled on the hardware to permit quick identification of intended use and location.
- F. Test Modes
1. The system shall include a provision that permits testing from any alphanumeric keypad. The test shall include standby battery, alarm bell or siren, and communication to the central station.
 2. The system shall include a provision for an automatic, daily, weekly, thirty (30) day, or up to sixty (60) day communication link test from the control panel installation site to the central station.
 3. The system shall include a provision for displaying the internal system power and wiring conditions. Internal monitors shall include the bell circuit, AC power, battery voltage level, charging voltage, panel box tamper, phone trouble line 1, phone trouble line 2, transmit trouble, and network trouble.
- G. Serial Interface
1. The control panel shall be capable of a serial interface to output information to a standard serial printer or serial interface to a communication port on a standard computer. Through control panel programming the system shall include a provision to allow the selection of which reports are to be output.
- H. Power Supplies
1. Power supplies for the control unit shall operate from 120 VAC, supplied at the respective protected areas. Standby batteries shall be supplied to power the system in the event of a utility power failure. Batteries shall be sized to provide 105% capacity for eight hours. Standby batteries shall be sealed lead-acid. Power supplies shall be all Solid State.
 2. Controls shall be designed to maintain full battery charge when alternating current is available. Batteries shall be recharged to 85% capacity within 24 hours from battery use. The system shall be automatically transferred to battery power upon loss of alternating current power and return to alternating current power upon restoration. Intrusion alarms shall not be initiated during switch over; a signal shall be initiated upon failure of battery or alternating current power.
 3. Approved power supplies shall meet or exceed the following power supply model specifications:
 - a. UL Listed DMP 505-12: 12VDC 5 amp with transformer and enclosure.
 - b. UL Listed DMP 504-24: 24 VDC 4 amps with transformer and enclosure.
- I. Software
1. The system shall interface with computer software with the capability to fully program the panel by connecting to the panel through:
 - a. Direct cable connection interface card
 - b. Receiver phone line connection
 - c. Standard phone line connection
 - d. Ethernet network connection
 - e. Network connection across the Internet

2. The system shall interface with computer software capable of locking down all controlled doors.
 3. The system shall interface with computer software capable of monitoring and logging all events.
 4. The system shall interface with computer software capable of exporting reports in the following file formats:

Excel spreadsheet (*.xls)	Text (*.txt)
Rich Text (*.rtf)	Comma-separated (*.csv)
Windows Metafile (*.wmf)	HTML document (*.htm)
QuickReport (*.qrp)	
 5. The system shall interface with computer software capable of printing custom, filtered reports including:

All Events	Door Access Granted
Zone Action	Door Access Denied
Arming/Disarming	Opening/Closing Schedule Changes
Area Late to Close	System Monitors
User Code Changes	System Events
- J. J. Control Panel Capability
1. The basic control panel shall provide:
 - a. Expansion to a total of at least 10,000 user codes with 99 user profile definitions.
 - b. Sixteen (16) independent door/keypad addresses, each with four zones.
 - c. Twenty (20) Holiday Dates for custom holiday scheduling by area.
 - d. A total door access granted event buffer of at least 10,000 events.
 - e. Anti-passback access control selectable by area and user.
 - f. Four (4) shift schedules per area.
 - g. A total of at least 100 programmable output relay schedules.
 - h. Thirty-two (32) individual reporting areas.
 - i. Built-in bell and telephone line supervision.
 2. The networked control panel shall provide:
 - a. All of the above features.
 - b. Require two-man access code or credentials.
 - c. Support programming to require the same or different access code entered within a programmed delay time of 1 to 15 minutes after disarming before activating a silent ambush alarm.
 - d. Support area programming that disables schedule and time-of-day changes while system is armed so that area can only be disarmed during scheduled times.
 3. The encrypted control panel shall provide:
 - a. All of the basic and network features listed above.
 - b. Built-in Encrypted Alarm Router.
 - c. Certified operation that meets 128 Bit AES Rijndael Encryption communications.
 - d. Certified operation that meets SCIF (Sensitive Compartmented Information Facility) application needs.
 - e. Certified operation that meets NIST (National Institute of Standards and Technology) standards.
 - f. Certification that encrypted panel is capable of meeting DCID 6/9 standards.
 - g. Certification that encrypted panel is capable of meeting UL 2050 standards.

2.4 INTEGRATED INTRUSION ALARM AND ACCESS CONTROL OPERATION

- A. Access Authority Levels
 - 1. The system shall be capable of programming access credentials authority levels to check whether the user has access to a specific area and also has the authority to disarm or arm the area. If the user access credential has access and disarm/arm authority the system shall provide the user the option to disarm the area simultaneously upon opening the door, or to open the door and begin an entry delay timer. With the timer option the user then disarms the area using an intrusion control keypad inside the area. If the user only has access authority to the area and the area is in an armed condition, the user is denied access to the area.
- B. Door Open Schedule Override
 - 1. The system shall be capable of programming certain area doors to be scheduled to unlock and lock at specific times of the day or night. The lock/unlock function shall be capable of an override option depending upon the area armed/disarmed status. If the area remains in an armed status at the scheduled unlock time the armed status overrides the unlock schedule ensuring the doors remain locked and armed in situations where the business might open late, close early, is affected by inclement weather, or another emergency.
- C. Common Area
 - 1. 1. The system shall be capable of programming a common area to be armed when the last area in the system is armed and disarmed when the first area in the system is disarmed. To ensure the common area works properly it shall not have any user codes assigned to the common area. The system shall also be capable of programming multiple common areas.
- D. Early Morning Ambush (XR500N and XR500E only)
 - 1. The system shall be capable of programming an area to require two user codes be entered within a programmed number of minutes to prevent an ambush message from being sent to the Central Station Receiver. If both user codes are not entered within the time an ambush message is sent to the central station receiver.
 - 2. 2. Both user codes shall have the authority to disarm the specific area and must be entered at the same keypad or reader. The keypad shall not display any indication that the ambush timer is running.
 - 3. 3. The system shall be capable of programming an output to provide an external indicator that an ambush situation is taking place.
- E. Two-Man Rule (XR500N and XR500E only)
 - 1. The system shall be capable of programming an area to require two separate user codes be entered in order to disarm and/or allow access to a specific area. Both required codes shall have at least the same or greater authority level. Both required codes shall be entered within 30 seconds or an alarm shall activate.
- F. Panic Button Summary Test (XR500N and XR500E only)
 - 1. The system shall have the ability to test panic buttons without sending a panic alarm to the Central Station Receiver.
 - 2. The system shall also have the ability to send panic zone test verification and failure results to the Central Station Receiver.
 - 3. During the test, each time a panic zone trips, the display number shall increment and the keypad buzzer sound for two seconds.
 - 4. The number of panic zones tripped shall constantly display until the test ends or no panic zone activity has occurred for 20 minutes.
 - 5. When the Panic Zone Test ends and a zone failed (did not trip) during the test, the keypad shall be able to display the zone name and number and have the buzzer sounds for one second. Additional zone failed zones shall display when a button is

pressed.

2.5 FALSE ALARM REDUCTION FEATURES

- A. The system shall be capable of providing false alarm reduction features, functions, capabilities, or processes that either require alarms be verified or potential alarms be corrected before a system or zone can be placed into an armed state.
- B. Exit Error Alert and Reporting
 - 1. The panel shall be able to provide an automatic function to prevent a false alarm from occurring if an exit door does not properly close after the system is armed.
- C. Entry and Exit Delay Annunciation
 - 1. When arming, the system shall provide clear annunciation indicators to the user about the need to exit the premises prior to the exit delay time expiring.
 - 2. When disarming, the system shall notify the user the need to disarm the system prior to the entry delay time expiring.
- D. Remote Annunciation
 - 1. The system shall be able to provide entry and exit delay time period notification. This notification can be from DMP keypads, remote annunciators, or bell tests.
- E. Abort Reporting
 - 1. The system shall be capable of sending an Abort report to the central station if the system is disarmed while the alarm is still sounding. The Abort report shall be sent after the alarm report to notify the central station that an authorized user has cancelled the alarm.
- F. System Testing
 - 1. The system shall offer testing features that are simple, quick, and complete and provide the highest measure of safety by ensuring that alarm conditions are detected and communicated to the proper authorities in a timely manner and on a regularly scheduled basis.
- G. Ambush Code
 - 1. The system shall offer ambush codes for those dangerous encounters where the user is instructed to either arm or disarm the system under threat of harm. The duress code shall disarm the system without giving local indication of an alarm that might put the user well-being in jeopardy.
- H. Two-Button Panic Feature
 - 1. The system shall support DMP keypads that provide the option to use only two-button panic codes. The user shall be required to press and hold two designated keys for approximately two seconds before the system generates a panic alarm.
- I. Cross-Zoning Protection
 - 1. The system shall support cross-zoning as a means of requiring two device trips to occur within a short period of time before sounding an alarm and sending an alarm report to the central station. Supported device trips shall be from one device that trips two times, or from two devices that each trip once.
- J. Swinger Zone Bypassing
 - 1. The system shall be capable of automatically bypassing a zone if it goes into an alarm or trouble condition a specified number of times within a one-hour period. The panel shall be able to track the number of times the zone trips while armed and compare

that against a programmed number. When that number is reached, the panel shall be able to automatically bypass the zone. The panel shall be capable of resetting the zone when the area to which it is assigned disarms, is manually reset from the keypad or remotely, or remains normal for one hour.

- K. Recently Armed Report
 - 1. The system shall be capable sending a System Recently Armed report, along with a zone alarm report, to the central station any time an alarm occurs within five minutes of the system arming. The System Recently Armed report allows the central station operator to follow a "call the subscriber first" procedure instead of immediately dispatching the police to what could be a false alarm.
- L. Transmit Delay
 - 1. The system shall be capable of programming the panel to wait up to 60 seconds before sending burglary alarm reports to the central station. If an alarm is accidental, the user shall be able to disarm the system within the programmed Transmit Delay time. An Abort report shall be sent in place of an alarm report after the system disarms. During the alarm, sirens and panel relay outputs shall not be delayed and shall still provide local condition annunciation.
- M. Call Waiting Cancel
 - 1. The system shall be capable of being programmed to cancel call waiting any time the panel dials the receiver number to send a report.
- N. Cancel/Verify
 - 1. The system shall be capable of sending either a Cancel Report or Verify Report to the Central Station to signify that the end user has Canceled an Alarm or Verified an Alarm condition.

2.6 2.6 BURGLARY CONTROL

- A. Area System
 - 1. The system user shall be capable of selectively arming and disarming any one or more of 32 areas within the intrusion detection system based on the user PIN code and/or keypad used. Each of the 574 zones shall be able to be assigned to any of the 32 available areas. The system shall be capable of having up to a sixteen (16) character length name programmed for each area.
 - 2. The system user shall be capable of assigning an opening and closing schedule to all areas or to each of the 32 areas separately. Each area shall be able to arm or disarm automatically by a schedule. The system shall have the capacity for common areas that automatically disarm when any other area disarms and that automatically arm when all others areas arm.
 - 3. The networked system shall have the ability to comply with Bank Safe & Vault application. The networked system shall also have the ability to use a two-man rule for disarming or allowing door access to an area. The system shall have the ability to operate a Common Area application.
- B. Zones
 - 1. The system shall have a minimum of eight (8) grounded burglary zones available from the control panel.
- C. Burglary Equipment
 - 1. Burglary detection equipment shall communicate to the system by way of the control panel loop expansion bus or 900MHz receiver.

2.7 ACCESS CONTROL

- A. Keypad
 - 1. The system shall display a message at any keypad when any system area remains disarmed past the scheduled closing time. The message shall be displayed at one minute past the scheduled closing time. A pre-warn tone shall also begin sounding. If the system is not armed or a schedule extended within ten minutes past the scheduled closing time, the system shall provide the option of sending a Late To Close report to the central station.
 - 2. The keypad shall include a door strike relay capable of sending a report to the central station when activated.
 - 3. The keypad shall be capable of proximity arming and disarming functions.
- B. Area Access Control
 - 1. The system shall be capable of integrating area access control capability where specified into the same control panel with the ability to have up to 10,000 user credentials. User access is limited to custom profiles and/or schedules. Anti-passback shall be available. The networked version shall support a Two-Man Rule feature. The system shall support up to sixteen (16) access doors, connected to the system using a manufacturer-approved interface module.
 - 2. Area door access products shall meet or exceed features offered by the following products:
 - 3. Keypad reader/administration device – DMP Model 7063/7063A, 7073/7073A, 7163, 7173
 - 4. Wiegand Interface – DMP Model 733, 734
 - 5. Reader – DMP Model PP-6005B, Model PR-5455, Model MP-5365
 - 6. Cards or credentials – DMP Model 1326, DMP Model 1306P, DMP Model 1346, DMP Model 1386
- C. Access Control Equipment
 - 1. Access Control equipment shall communicate to the system by way of the control panel keypad bus.

2.8 COMPILED DETECTION EQUIPMENT LISTING

- A. Hard-wired
 - 1. Hard-wired detection equipment shall communicate to the system by way of the control panel loop expansion bus. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
 - a. Motion Detector – DMP Model 6155LX (wall mount with built-in zone expander)
 - b. Motion Detector – DMP Model AP669 (ceiling mount 360' – requires DMP zone expander)
 - c. Glass Break Detector – DMP Model 5845LX (includes built-in zone expander)
 - d. Door Contact – DMP Model SD70 (concealed applications – requires DMP zone expander)
 - e. Bus Splitter/Repeater Module – DMP Model 710
 - f. Door Contact – DMP Model SM20WG (surface applications – requires DMP zone expander)
 - g. Output Expansion Module - DMP Model 716
 - h. Graphic Annunciator Module - DMP Model 717
- B. Wireless

1. Wireless detection equipment shall communicate to the system by way of a compatible 900MHz receiver utilizing two way communications, capable of receiving up to 500 wireless zones. The wireless system shall be programmed directly from the control panel, and shall not require a separate device programmer. The wireless detection equipment shall have a one (1) year warranty. It shall be capable of sending transmitter and battery status to the control panel's compatible receiver up to once every 60 seconds and must meet or exceed the following products:
 - a. Input transmitter – DMP Model 1101, 1102
 - b. Pendant Panic Transmitter – DMP Model 1147, 1146, 1145
 - c. Panic Transmitter – DMP Model 1142
 - d. Wireless Receiver – DMP Model 1100X, 1100XI, 1100XH
- C. Notification Devices
 1. Notification equipment shall be control panel activated by way of the supervised bell output module. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
 - a. Bells – Wheelock Model MB-G6-12, MB-G10-12, MB-G6-24, MB-G10-24
 - b. Horns – Wheelock Model MT-12/24, NH-12/24, MIZ-24, AH-24, AH-24WP
 - c. Strobe – Wheelock Model RSS-121575W, RSS-24MCW
 - d. Horn Strobe – Wheelock Model MTWP=2475W, NS-121575W, NS-24MCW, AS-24MCW
 - e. Notification Modules – DMP Models 865, 866, 867,
 - f. Notification/Synchronization Modules – DMP Models 831, 832
- D. D. Power Supplies and Transformers
 1. Power supply, transformer, and battery devices shall maintain system operation. The batteries shall be checked and replaced every three to five years. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
 - a. Power Supply – DMP Model 505-12, 115 VAC, 12 VDC
 - b. Power Supply – DMP Model 505-12LX, 115 VAC, 12 VDC
 - c. Transformer - DMP Model 327, 16.5 VAC 50 VA, Plug-in
 - d. Transformer - DMP Model 322, 16.5 VAC 56 VA, Wire-in
 - e. Transformer - DMP Model 323, 16.5 VAC 56 VA, Wire-in
- E. Access Control Equipment
 1. Access control equipment shall provide access control functions between the panel and controller door access points. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
 - a. Interface Module – DMP Model 734, Wiegand
 - b. Egress Module – DMP Model PB-2 REX Button
 - c. Reader – DMP Model PP-6005B Proxpoint Plus©
 - d. Reader – DMP Model MP-5365 Miniprox©
 - e. Reader – DMP Model MX-5375 Maxi-Prox™
 - f. Reader – DMP Model TL-5395 Thinkline II™
 - g. Door Controller – DMP Model 1306P Prox Patch™
 - h. Door Controller – DMP Model 1306PW Prox Patch™
 - i. Access Card – DMP Model 1351 ProxPass© Card
 - j. Access Card – DMP Model 1326 Proxcard II© Card
 - k. Access Device – DMP Model 1346 Proxkey II™ Keyfob, 1386 Isoprox II©

PART 3 EXECUTION

3.1 INSTALLATION

- A. Integration with Access & Security Management Software
 - 1. Provide all licensing, modules, programming, configuration, graphical backgrounds, etc. as required to integrate with the District's WAN access & security management software and support all utilized features.
 - 2. Provide any available software updates to the access & security management software.
- B. Connection of master control unit to expansion modules shall be accomplished via the fiber optic cables common to the data network. There will be no separate OSP copper cabling allowed for the intrusion system.
- C. Each intrusion device (door/window magnetic switch, glass break sensor, motion sensor, etc.) shall be connected to a dedicated zone. Provide zone expansion modules as needed.
- D. Provide all wiring to devices and components in accordance with the manufacturer's recommendation.

END OF SECTION 28 16 00

SECTION 28 23 23

VIDEO SURVEILLANCE SYSTEMS

PART I - GENERAL

1.1 RELATED SECTIONS

- A. Section 27 10 00 – Data Communications

1.2 SCOPE OF WORK

- A. Furnish all labor, and materials for, and comply with the performance requirements of the video surveillance system indicated in the drawings and specified herein.
- B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required to accomplish work indicated or specified in this or other sections, it shall be the responsibility of the Contractor to provide all materials and equipment which is usually furnished with such systems in order to complete the installation, whether or not specifically mentioned herein.

1.4 SYSTEM DESCRIPTION

- A. An internet protocol (IP) based video surveillance system, consisting of IP cameras, PoE switches, network video recorder (NVR) servers, copper cabling, fiber optics, transceivers, software applications, etc.

1.5 SUBMITTALS

- A. Manufacturer's Specifications, Drawings, and Supplemental Data
 - 1. Manufacturer's specifications, cut sheets, and drawings shall be submitted for all equipment pertaining to the project.
 - 2. The products that are being utilized on the project shall be clearly identified on all cut sheets by highlighting or similar method.
 - 3. The cut sheets and supplemental data called for shall be submitted as the instruments of the Contractor, even though they may have been prepared by a subcontractor, supplier, dealer, manufacturer, or by any other person, firm or organization. Prior to submission, the Contractor shall undertake its own review and stamp with its acceptance, then submit to the Project Engineer for their review.
- B. Submittal Organization
 - 1. The submittal package shall be neatly bound in a report style folder. The folder cover shall bear the project name, as well as the name of the contractor supplying the submittal. The package shall be outlined as follows:
 - a. Copper cables - Cable, patch panel inserts
 - b. Camera outlet - Wall plates, decora inserts, and blank inserts
- C. Submittal Distribution

1. Copies of the submittal package shall be as follows:
 - a. One for the Engineer of Record.
 - b. One for the Construction Manager.
 - c. Two for the Owner's staff.
 - d. One for the Contractor's job files, and such additional copies as the Contractor may desire.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Arecont Vision
425 East Colorado Street, 7th Floor, Glendale, CA 91205
Phone (877) CAMERA8. Website: www.arecontvision.com
- B. Hewlett-Packard USA
20555 SH 249, Houston, TX 77070
Phone (281) 370-0670. Website: www.hp.com
- C. Exacq Technologies, Inc.
11955 Exit Five Parkway, Bldg 3, Fishers, IN 46037
Phone (317) 845-5710. Website: www.exacq.com

2.2 CAMERAS

- A. 5MP Dome Camera Assembly: Arecont Vision #AV5155DN
 1. 5 megapixel sensor, IR corrected
 2. Fully adjustable gimbal with 360° pan, 90° tilt, 360° z-axis
 3. Day and night mode w/ motorized IR cut filter
 4. H.264 compression and MJPEG at full resolution
 5. IP66 vandal-resistant dome and housing
 6. Lensing as appropriate for the desired target area
- B. 8MP 180° FOV Dome Camera Assembly: Arecont Vision #AV8185DN
 1. (4) 2 megapixel sensors, 45° FOV each
 2. Day and night mode w/ motorized IR cut filter
 3. H.264 compression and MJPEG at full resolution
 4. IP66 vandal-resistant dome and housing
- C. 8MP 360° FOV Dome Camera Assembly: Arecont Vision #AV8365DN
 1. (4) 2 megapixel sensors, 90° FOV each
 2. Day and night mode w/ motorized IR cut filter
 3. H.264 compression and MJPEG at full resolution
 4. IP66 vandal-resistant dome and housing
- D. 10MP Long Range Camera Assembly: Arecont Vision #AV10005DN
 1. Day and night mode w/ motorized IR cut filter
 2. H.264 compression and MJPEG at full resolution
 3. IP66 vandal-resistant dome and housing
 4. Lensing as appropriate for the desired target area

VIDEO SURVEILLANCE SYSTEMS

- E. Mounting Hardware: Arecont Vision
 - 1. #MD-EBA Electrical box adapter
 - 2. #MD-WMT Wall mount bracket
 - 3. #MD-PMT Pendant mount bracket
 - 4. #MD-CRMA Corner mount bracket
 - 5. #MD-PMA Pole mount bracket

2.3 NVR SERVER

- A. Hardware: exacqVision #IPS-6000-R2 with Dual Network Interface Cards
 - 1. 2U rack mountable server
 - 2. Expandable to 64 IP cameras
 - 3. Supports 5MP cameras, H.264 compression, analytics
 - 4. Integrates with leading access control systems
 - 5. 1Gbit 1000Base T RJ45
 - 6. 3 year warranty, parts and labor
- B. Software:
 - 1. exacqVision VMS server
 - a. Pre-installed on NVR
 - 2. exacqVision client
 - a. Freeware application
 - b. Available for Windows, Linux, Macintosh platforms
 - 3. Web browser/Mobile Device Access
 - a. Compatible with Explorer, Firefox, Safari, Opera, Chrome web browsers
 - b. Compatible with iPhone, BlackBerry, Windows Mobile OS, other devices
- C. Licensing: exacqVision
 - 1. EVIP-01 (one license required per camera)

2.4 PoE SWITCH

- A. 8-Port Switch: HP ProCurve 2520G-8-PoE (J9298A) or newest model
- B. 24-Port Switch: HP ProCurve 2520G-24-PoE (J9299A) or newest model
- C. Mini-GBIC/SFP: HP ProCurve Gigabit-SX-LC (J4858C) or newest model

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive the video surveillance system infrastructure.
 - 1. Notify Engineer of conditions that would adversely affect install or subsequent use.
 - 2. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install cameras shown in plans at specific locations to be identified by the district's project manager. The indicated location shall dictate the required mounting bracket for the camera. Cameras shall be aimed, zoomed, and focused to the satisfaction of the District. Lensing may be changed as required to clearly image the desired field of view. Configure for video at 5 frames per second, full resolution, H.264 compression.
- B. Provide (2) CAT6 cables to each camera from the respective data frame PoE switch. Leave 15' slack for repositioning of the camera, if required. Terminate cables to dedicated surveillance camera patch panels.
- C. Horizontal cabling jackets, patch cable jackets, and modular RJ-45 jacks serving the video surveillance system shall be yellow in color. All cabling shall be installed and labeled in accordance with 27 20 00.
- D. Install dedicated PoE switches for surveillance cameras. These switches shall form a dedicated 1000Base-SX network for the video surveillance system.
- E. Install NVR at the building's main distribution frame. Connect surveillance LAN switches to the NVR using a single NIC. Connect the NVR to the public LAN via the second NIC.
- F. Purchase one license per camera for connection to the NVR server application
- G. Install client software on (3) computers at each building. Configure site clients to connect to their local NVR server. Configure district clients to connect to all NVR servers installed under these contract documents.
- I. Provide all configuration of cameras, switches, NVR server, etc. The contractor shall explain all functions and possible configurations to the District project manager and then program the system according their directive.

3.3 TESTING

- A. Test horizontal cabling in accordance with 27 20 00.
- B. Test client applications for proper connection to NVR server and for function. Contractor shall provide all troubleshooting, programming, etc. to make client application function per manufacturer specifications.
- C. Test NVR server for proper connection and recording of video from each camera. Test NVR for proper function within manufacturers specifications.
- D. Testing of items (B) and (C) shall be performed in the presence of the District project manager and the engineer.

END OF SECTION

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 26 05 00 – Common Work Results for Electrical
- B. Section 26 20 00 – Low Voltage Electrical Transmission
- C. Section 27 00 00 – Communications
- D. Section 28 00 00 – Electronic Safety and Security

1.2 REFERENCES

- A. Electrical Industries Association (EIA):
 - 1. EIA-232-D – Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
 - 2. TIA-485-A – Electrical Characteristics of Generators and Receivers for Use in Balanced Multipoint Systems
- B. California Code of Regulations
 - 1. Title 24, Part 3 – California Electrical Code (CEC)
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 12 – Standard on Carbon Dioxide Extinguishing Systems.
 - 2. NFPA 13 – Installation of Sprinkler Systems.
 - 3. NFPA 15 – Standard for Water Spray Fixed Systems for Fire Protection.
 - 4. NFPA 16 – Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.
 - 5. NFPA 16A – Standard for the Installation of Closed Head Foam-Water Sprinkler Systems.
 - 6. NFPA 70 – National Electrical Code (NEC)
 - 7. NFPA 72 – National Fire Alarm Code.
 - 8. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 9. NFPA 101 – Life Safety Code.
 - 10. NFPA 750 – Standard on Water Mist Fire Protection Systems.
 - 11. NFPA 5000 – Building Construction and Safety Code.
- D. Underwriters Laboratories (UL):
 - 1. UL 268 – Standard for Smoke Detectors for Fire Alarm Signaling Systems.
 - 2. UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems.
 - 3. UL 1971 – Standard for Signaling Devices for the Hearing Impaired.

1.3 SCOPE OF WORK

- A. Furnish all labor, equipment, and materials for, and comply with the performance requirements of the Fire Alarm System indicated in the drawings and specified herein.
- B. It is the intent of the Contract Documents to provide an installation complete in every

respect. In the event that additional details or special construction is required to accomplish work indicated or specified in this or other sections, it shall be the responsibility of the Contractor to provide all materials and equipment which is usually furnished with such systems in order to complete the installation, whether or not specifically mentioned herein.

1.4 SYSTEM DESCRIPTION

- A. A new intelligent reporting, fully peer-to-peer, microprocessor-controlled fire detection and notification system shall be installed in accordance with the specifications and as indicated on the Drawings.
- B. Basic Performance:
 - 1. Network Communications Circuit Serving Network Nodes: Connected using approved fiber optic cable or 18/2 twisted pair copper cable between nodes.
 - 2. Signaling Line Circuits (SLC) Serving Addressable Devices: Wired Class B.
 - 3. Initiation Device Circuits (IDC) Serving Non-addressable Devices Connected to Addressable Monitor Modules: Wired Class B.
 - 4. Notification Appliance Circuits (NAC) Serving Strobes and Horns: Wired Class B.
 - 5. Alarm Signals Arriving at Control Panel: Not lost following primary power failure until alarm signal is processed and recorded.
 - 6. Network Node Communications:
 - a. Communicated between panels on fiber optic cables.
 - b. To enhance system survivability, ability to operate on loss of Command Center, short or open of entire riser at Command Center shall be demonstrated at time of system acceptance testing.
 - c. Systems that are not capable of providing true Style 7 riser performance shall not be acceptable.
 - 7. Signaling Line Circuits (SLC):
 - a. Reside in remote panels with associated audio zones.
 - b. SLC modules shall operate in peer-to-peer fashion with all other panels in system.
 - c. On loss of Command Center, each remaining panel shall continue to communicate with remainder of system, including all SLC and control functions. Systems that provide a "Degraded" mode of operation upon loss of Command Center or short in riser shall not be acceptable.
 - d. Limit the number of devices to 80% of the maximum allowed of each type on SLC circuits.
 - 8. Notification Appliance Circuits (NAC), and Control Equipment:
 - a. Arranged such that loss of any 1 NAC circuit will not cause loss of any other NAC circuit in system.
 - b. Electrically supervised for open and short circuit conditions.
 - c. If short circuit exists on NAC circuit, it shall not be possible to activate that circuit.
 - d. Voltage drop is not to exceed 10% at the furthest point on any NAC circuit.
 - 9. Standby Power:
 - a. Provide a minimum of 20% spare battery capacity above calculated requirements.
- C. Sequence of Operations:
 - 1. General Alarm: Upon alarm activation of any area smoke detector, duct smoke detector, heat detector, manual pull station, or sprinkler water flow switch, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.

The LCD Display shall indicate all applicable information associated with the alarm condition including zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.

The notification signals and actions shown on the plans shall occur simultaneously.

2. Supervisory Operation: Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, clean agent fire suppression system trouble, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.

The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.

Transmit signal to the central station with point identification.

3. Trouble Operation: Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.

The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.

Transmit signal to the central station with point identification.

4. Monitor Operation: Upon activation of any device connected to a monitor circuit (fire pump/emergency generator status), the following functions shall automatically occur:

The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

D. D. Fire Alarm System Functionality:

1. Provide complete, electrically supervised distributed, networked analog/addressable

- fire alarm and control system, with analog initiating devices.
2. Each Network Node: Incorporate Boolean control-by-event programming, including as a minimum AND, OR, NOT, and Timer functions.
 3. Control Panels: Capability to accept firmware upgrades via connection with laptop computer, without requirement of replacing microchips.
 4. Network:
 - a. Based on peer-to-peer token ring technology operating at 625 K baud, using Style 7 configuration.
 - b. Capability of using twisted-pair wiring, pair of fiber optic cable strands up to 200 microns, or both, to maximize flexibility in system configuration.
 5. Each Network Node:
 - a. Capability of being programmed off-line using Windows-based software utilized by fire alarm system manufacturer. Capability of being downloaded by connecting laptop computer into any other node in system. Systems that require system software to be downloaded to each transponder at each transponder location shall not be acceptable.
 - b. Capability of being grouped with any number of additional nodes to produce a "Region", allowing that group of nodes to act as 1, while retaining peer-to-peer functionality. Systems utilizing "Master/Slave" configurations shall not be acceptable.
 - c. Capability of annunciating all events within its "Region" or annunciating all events from entire network, on front panel LCD without additional equipment.
 6. Each SLC Network Node: Capability of having integral DACT (digital alarm communicator transmitter) that can report events in either its region, or entire network to single central station monitoring account.
 7. Each Control Panel: Capability of storing its entire program and allow installer to activate only devices that are installed during construction, without further downloading of system.
 8. Password Protection: Each system shall be provided with 4 levels of password protection with up to 16 passwords. Passwords shall be provided to owner.

1.5 QUALITY ASSURANCE

- A. To ensure reliability and complete compatibility, all items of fire alarm system, including control panels, power supplies, initiating devices, and notification appliances, shall be listed by Underwriters Laboratories Inc. (UL) and shall bear the "UL" label.
- B. Fire Alarm Control Panel Equipment: UL-listed under UL 864 Ninth Edition.
- C. Equipment, Programming, and Installation Supervision:
 1. The contractor is required to hold a C-10 license and any other certifications required by the Authority Having Jurisdiction.
 2. The contractor is required to be an approved engineered systems distributor of Edwards for equipment, programming, and installation supervision.
 3. Proof of factory training shall be delivered within 14 calendar days of award of the Contract.
- D. Software Modifications:
 1. Provide services of Notifier factory-trained and authorized technician to perform system software modifications, upgrades, or changes.
 2. Provide use of all hardware, software, programming tools, and documentation necessary to modify fire alarm system software on-site.
 3. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones.
 4. System structure and software shall place no limit on type or extent of software

- modifications on-site.
5. Modification of software shall not require power-down of system or loss of system fire protection while modifications are being made.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials from damage during handling and installation.

1.7 COORDINATION

- A. Coordinate the Work of this section with the Work of other sections, including sprinkler systems, elevators, HVAC systems, and security/door locking systems, as applicable.

1.8 WARRANTY

- A. Warranty Period for System Equipment: 1 year from date of final acceptance.
- B. Trouble Calls: The contractor shall guarantee on-site service for the Fire Alarm System within 24 hours of the receipt of a trouble call.

1.9 SUBMITTALS

- A. Shall be in accordance with section 280000 and the General Conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Refer to the plans for manufacturers and part numbers.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive fire alarm system.
1. Notify Architect of conditions that would adversely affect installation or subsequent use.
 2. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install fire alarm system in accordance with NFPA 72, NFPA 70, state and local codes, manufacturer's instructions, and as indicated on the Drawings.
- B. Smoke detectors shall neither be installed within 36 inches of any HVAC supply or return air grille, to include air handling light fixtures, nor within 12 inches of any wall.

- C. Smoke detectors shall not be installed before system programming and test period. If construction is ongoing during this period, take measures to protect smoke detectors from contamination and physical damage.
- D. Wall mounted notification appliances shall be installed not lower than 80 inches and not higher than 96 inches, above finished floor. Devices shall be not be mounted within 6 inches of the ceiling.
- E. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated in the Contract Documents not meet this requirement, it shall be the responsibility of the Contractor to bring it, in writing, to the attention of the Engineer.
- F. Flush-mount fire detection and alarm system devices, control panels, and remote annunciators in finished areas. Flush-mount or surface-mount fire detection and alarm system devices, control panels, and remote annunciators in unfinished areas.
- G. Ensure manual stations are suitable for surface mounting or semi-flush mounting as indicated on the Drawings. Install stations at 48 inches above finished floor, measured to operating handle.
- H. End of Line Resistors shall be furnished as required by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled so as not to require removal to identify the EOL device.
- I. Addressable modules shall be mounted within 36 inches of the monitored or controlled point of termination. This shall include, but is not necessarily limited to, fan shutdown, elevator recall, shunt trip, sprinkler status points, or door release. Label all addressable modules as "FIRE ALARM SYSTEM" and to their function, e.g., "FAN F-1 SHUTDOWN".
- J. Conduit/Raceways, Junction Boxes:
 - 1. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems may be installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
 - 2. The fire alarm system cabling / wiring shall be installed in RED color conduit, minimum size 3/4". In upgrade projects, existing fire alarm system conduit may be reused, if serviceable. Paint existing conduits red to match new.
 - 3. All junction box covers shall be painted red.
 - 4. Minimum conduit size shall be 3/4" trade size.
 - 5. Conceal conduit, junction boxes, and conduit supports and hangers in finished areas. Conceal or expose conduit, junction boxes, and conduit supports and hangers in unfinished areas. Concealed installation is preferred wherever possible.
- K. Cables & Conductors:
 - 1. Cables & conductors shall be labeled at both ends as to their origin and destination; e.g. "FACP - i1-1" indicates the origin as the FACP and the destination as initiation device "i1-1". Utilize Panduit labels (or equivalent), size MP-150c through MP-350, as required by the amount of information on the label.
 - 2. Splices in wiring are permitted only at terminal cabinets, or locations specifically approved by the Engineer. Do not splice in conduit, pull boxes, inaccessible locations, etc.
- L. Terminal Cabinets:
 - 1. Wiring shall be neatly bundled, fanned, tagged, and laced. Leave minimum three

- inches fan space between terminal block connection and vertical wiring. Incoming wiring shall terminate on the left, outgoing on the right.
2. Wire terminations at devices and terminal strips shall be "spade" type terminal connections, Sta-Kon, or equivalent.
 3. Terminal barrier strips shall be Cinch 142 series (or equivalent) with minimum six points. Leave minimum two space separation between types of system cables. Provide minimum four spare termination points.
- M. Coordinate the required space in the Data equipment frames with this and other network based systems. Provide racks with sufficient space to accommodate all systems.

3.3 SYSTEM UPGRADES

- A. When upgrading an existing system, the existing fire alarm shall be tested in the presence of an assigned representative of Central Unified School District prior to any work being started by a contractor. Upon completion of testing, it shall be the contractor's responsibility to note any discrepancy with the existing system. It will be contractor's responsibility to provide and complete a working system, minus any discrepancies noted.
- B. When upgrading an existing system, all end of line resistors shall be changed out to meet the manufacturer's specifications for each fire panel. Install the latest software updates on existing equipment to be reused.
- C. When specifications call for the removal of existing equipment, that equipment shall be returned to the District.

3.4 FIELD QUALITY CONTROL

- A. A. Manufacturer's Field Services: Provide service of competent, factory-trained technician authorized by manufacturer to technically supervise and participate during pre-testing and acceptance testing of system.
- B. B. Testing:
 1. Conduct complete visual inspection of control panel connections and test wiring for short circuits, ground faults, continuity, and insulation before energizing cables and wires.
 2. Close each sprinkler system control valve and verify proper supervisory alarm at Control Panel.
 3. Verify activation of flow switches.
 4. Open initiating device circuits and verify that trouble signal actuates.
 5. Open signaling line circuits and verify that trouble signal actuates.
 6. Open and short notification appliance circuits and verify that trouble signal actuates.
 7. Ground initiating device circuits and verify response of trouble signals.
 8. Ground signaling line circuits and verify response of trouble signals.
 9. Ground notification appliance circuits and verify response of trouble signals.
 10. Check installation, supervision, and operation of intelligent smoke detectors.
 11. Introduce on system each of the alarm conditions that system is required to detect. Verify proper receipt and proper processing of signal at Control Panel and correct activation of control points.
 12. Consult manufacturer's manual to determine proper testing procedures when system is equipped with optional features. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality, and similar.
- C. C. Acceptance Testing:

1. The contractor's job foreman and an assistant, in the presence of a representative of the manufacturer, an assigned representative of Central Unified School District, and the assigned inspector of the AHJ, shall perform a test of the system. All attending personnel shall be given reasonable notice so as to make themselves available for the test.
2. Operate every installed device to verify proper operation and correct annunciation at the control panel.
3. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.
4. Completely disconnect main Control Panel from rest of network. Activate initiating device. All control outputs supported by transponder SLC circuits shall operate under project programming mode. Default or degrade mode programming shall not be acceptable.
5. Complete any additional testing required by the AHJ.
6. When testing has been completed to satisfaction of both Contractor's job foreman, representatives of the manufacturer and Owner, and the inspector of the AHJ, a notarized letter co-signed by each attesting to satisfactory completion of said testing shall be forwarded to the Owner and fire department.
7. Leave fire alarm system in proper working order and, without additional expense to Owner, replace defective materials and equipment provided within 1 year (365 days) from date of final acceptance by the owner.

3.5 DEMONSTRATION

- A. Provide 4-hour's instruction class to the district's designated personnel for operating the fire alarm system.
- B. Provide hands-on demonstrations of operation of fire alarm system components and functions.

END OF SECTION 28 31 00

SECTION 31 11 00 SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY:

- A. This Section includes the following:
 - 1. Provide all material, labor, equipment and services necessary to completely clear and demolish all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. RELATED SECTIONS:
 - 1. Contract General Conditions and Division 1, General Requirements
 - 2. Section 312000 – Earthwork: Excavation, Filling, and Grading
 - 3. Section 312222 – Soil Materials
 - 4. Section 312333 – Trench Excavation and Backfill

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. In accordance with Specification Section GENERAL REQUIREMENTS, and the following:
 - a. Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board [CARB] and the Environmental Protection Agency [EPA].
- B. Meetings:
 - 1. Minimum agenda shall be to discuss coordination of upcoming work, review the work progress, discuss field observations, identification of any potential problems which may impede planned progress; corrective measures to regain projected schedule; and maintenance of quality and work standards.
 - 2. Meetings shall include Pre-Clearing and Demolition Meetings.
 - 3. Participants (or designated representative of) invited to attend each of the above meetings shall be as follows:
 - a. Contractor.
 - b. Owner.
 - c. Architect.
 - d. Testing Laboratory.
 - e. Local Governing Authorities as applicable.
 - f. Utility Representatives as applicable.
 - g. Owner's Inspector.
 - h. Clearing and Demolition Subcontractor.
 - i. Other subcontractors, as appropriate (including any accessory subcontractors).

1.4 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Dust Control

1. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
 2. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
 3. No construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan, if one is required.
 4. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.
 5. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefor.
- B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
 2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives, walks or occupied facilities.
 - a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Authorities having jurisdiction.
 - b. Provide alternate routes around closed or obstructed traffic ways if required by Authorities having jurisdiction.
 3. Locate and identify utilities.
 - a. Call a Local Utility Locator Service (USA – “Underground Service Alert” – [800] 227-2600) for the task of locating any applicable utilities in the area where the Project is located.
 4. Carefully remove items indicated to be salvaged and store on Owner’s premises at the Owner’s direction.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordination:
1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
1. Protect and maintain all benchmarks and survey control points from disturbance during clearing and demolition operations.
 2. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties.
 3. Furnish and install temporary protection/barrier fencing surrounding the limits of demolition.

4. Protect trees, plant growth, and features not specifically designated for removal. Locate and clearly flag trees and vegetation to remain or to be relocated.
5. Protect existing improvements designated to remain from damage during construction.
 - a. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.2 CONSTRUCTION

- A. Vegetation, Shrub, Topsoil, Weed Removal:
 1. Remove weeds and rooted topsoil to a minimum three (3) inch depth and temporarily stockpile as needed for re-use in finished grading of landscape areas. Remove excess material from the site.
 2. Where existing vegetation is to be replaced by new materials, remove contaminated or excess soil from the site and legally dispose of off-site.
- B. Existing Site Improvements Removal:
 1. Remove existing above and below grade improvements as necessary to facilitate new construction.
 - a. Remove concrete slabs, sidewalk, curbs, mow strips, gutters, and fence post footings.
 - 1) Neatly saw-cut length of existing pavement to remain before removing existing pavement unless existing full-depth joints coincide with line of demolition. Saw-cut faces vertically.
 - b. Remove indicated utility improvements within the limits of construction.
 - 1) Excavate for and disconnect utilities designated to be removed. Seal or cap off underground.
 - 2) Coordinate removal and/or relocation of utilities with the appropriate utility agencies.
 - c. Where existing underground utilities, irrigation pipes, wells, leach fields, or underground tanks are encountered, they must be removed or moved to a point at least 5 feet horizontally outside the proposed building and 3 feet horizontally outside the concrete flatwork or pavement construction areas. All resultant cavities must be backfilled with engineered fill.
 - d. Remove concrete slabs, foundations, and utilities within building footprint.
- C. Existing Utilities to Remain or be Relocated:
 1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - a. Notify Architect and the Owner not less than seven (7) days in advance of proposed utility interruptions.
 - b. Arrange to shut off indicated utilities with utility companies and Owner.
- D. Disposal:
 1. Legally dispose of all debris (surplus soil materials, unsuitable topsoil, obstructions, demolished materials, waste materials, trash, etc.) resulting from clearing, grubbing, demolition and from construction. Disposal of all materials shall be at a location secured by the Contractor off of the Owner's property.

END OF SECTION 31 11 00

SECTION 31 20 00 EARTHWORK: EXCAVATION, FILLING AND GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY:

- A. This Section includes the following:
 - 1. Excavating soil and other material for surface improvements.
 - 2. Placing fill.
 - 3. Compaction of existing ground and fill.
 - 4. Preparation of subgrade for other improvements.
 - 5. Grading of soil.
- B. RELATED SECTIONS
 - 1. Contract General Conditions and Division 1, General Requirements
 - 2. Section 311100 – Site Clearing
 - 3. Section 312222 – Soil Materials
 - 4. Section 312333 – Trench Excavation and Backfill

1.3 REFERENCES

- A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.
- B. A Geotechnical Engineering Investigation Report has been prepared for the project by BSK Associates; BSK Project No. G00001118, dated July 14, 2023. A copy of the report is available (for reference only) at the cost of reproduction. Contact BSK Associates if a copy of the report is desired.

1.4 DEFINITIONS

- A. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Information indicating the source of all import material, the fill material type and where it is to be used, and approval of the District's Inspector of Record for incorporation of import material into the Work.
- B. Material Test Reports:
 - 1. Classification of Soils.
 - 2. Compaction Characteristics of Soils.
 - 3. Density and Unit Weight of Soils in Place.
 - 4. Imported fill shall be tested and approved by the Owner's Geotechnical Engineer prior to import to the site, including testing for compliance with Department of Toxic Substances Control (DTSC) guidelines. Said testing and certification documents shall be paid for by the Owner.

- C. Project Closeout: In accordance with Specification Section PROJECT CLOSEOUT.
 - 1. Drawings indicating the extent and depth of all engineered fill, and overexcavation and recompaction. This information shall be a part of the Project "As-Built" and Project "Record" Documents in accordance with the Specification Section PROJECT DOCUMENTS.

1.6 QUALITY ASSURANCE

- A. Installer:
 - 1. Qualifications:
 - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.
- B. Regulatory Requirements:
 - 1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:
 - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
 - b. CM City of Madera, Codes and Ordinances
 - c. EPA Environmental Protection Agency.
 - d. CAL/OSHA Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.
 - e. DTSC Comply with all recommendations of the California Department of Toxic Substance Control (DTSC) regarding soil testing for potential contaminants.
- C. Certificates:
 - 1. Installer's certification that all Earthwork installation meets or exceeds the requirements of this specification.
 - 2. Contractor's certification (on Contractor's letterhead paper) that the Earthwork materials and installation meets or exceeds the requirements of this specification.
- D. Meetings:
 - 1. Pre-Installation: Schedule prior to the start of work.
 - a. Coordinate the work with other work being performed.
 - b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
 - 2. Progress: Scheduled by the Contractor during the performance of the work.
 - a. Review for proper installation of work progress.
 - b. Identify any installation problems and acceptable corrective measures.
 - c. Identify any measures to maintain or regain project schedule if necessary.
 - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
 - a. Inspect and identify any problems which may impede issuance of warranties or guaranties.
 - b. Maintain installed work until the Notice of Substantial Completion has been filed.

1.7 COORDINATION

- A. Coordinate work with Owner's personnel.

- B. Provide required notification to the Owner and Geotechnical Engineer or the Engineer of Record so that a representative from the Owner's Geotechnical Engineering consultant can be present for all excavation, filling and grading operations to test and observe earthwork construction.
- C. Verify that the location of existing utilities has been indicated at work site by utility authorities, by Owner, and as specified on the Plans.

1.8 EXISTING CONDITIONS

- A. Existing Conditions:
 - 1. Examine the site and verify conditions with the Drawings and Specifications. Contractor shall familiarize himself with existing site conditions and any changes that have occurred at the site since the preparation of the contract documents and shall be responsible to account for any such changes in the price bid for this work.
 - 2. Thoroughly investigate and verify conditions under which the Work is to be performed.
 - 3. Locate and identify utilities:
 - a. Call a Local Utility Locator Service (USA - "Underground Service Alert" – [800] 227-2600) for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.
 - 4. No allowance for Extra Work will be granted resulting from negligence or failure to meet requirements of this Section.
- B. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete flatwork, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunk line utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. Under similar circumstance, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- D. Determine exact location of existing buried utilities by:
 - 1. Marking on ground or pavement surface the alignment and extent of the facilities and the probable location of existing utilities using construction plans and existing surface features.
 - 2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations and notify Owner of said request concurrently.
 - 3. Confirm exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.
- E. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.
- F. Provide Field Engineering to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under this Contract, submit detailed information to the Engineer for review and direction.

- G. Maintain all existing utility mains and service lines in constant service during construction of the Work.
- H. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work, and coordinate the timing of any such disruptions in advance with the District.
- I. Existing soils are considered to have a low expansion potential.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
 - 1. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, or vegetative ground cover.
 - 2. All land clearing, demolition, grubbing, scraping, excavation, land leveling, grading, and cut and fill activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by pre-soaking.
 - 3. When materials are transported off-site, all material shall be covered, effectively wetted to limit visible dust emissions or at least six inches of freeboard space from the top of the container shall be maintained.
 - 4. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are occurring. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. The use of blower devices is expressly forbidden.
 - 5. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/ suppressant.
 - a. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
 - b. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. If required, Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
 - c. If a dust control plan is required, no construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan.
 - d. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.
 - e. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefore
- B. Burning: No burning will be allowed on-site.
- C. Rain: Work under this section shall not be started or maintained under threat of rain, unless the work is not affected by the rain.
- D. Do not place fill during weather conditions which will alter moisture content of fill materials sufficiently to make compaction to the specified densities difficult or impossible.

- E. When reference is made to SWPPP (Storm Water Pollution Prevention Plan), if any within this Project Manual, then comply with all environmental protection requirements included therein.
- F. In accordance with EPA, CARB and CM.
- G. Protection:
 - 1. Protect cut and fill areas to prevent water running into excavation. Maintain areas free of water. Remove seeping water immediately by pumps. Provide dewatering as necessary.
 - 2. Protect cut slopes from erosion due to precipitation and other sources of runoff.
 - 3. Protect utilities to remain within the construction area and special construction. If utility lines are uncovered (water, electric, sewer, etc.) not shown on the drawings during excavation of site, notify the Architect promptly for its review and action.
 - 4. Do not permit access to undeveloped portions of the site, nor to areas that are outside of the limits of grading.
- H. Before being brought onto the site, all import soil must be sampled, tested and approved by Owner's Geotechnical Engineer. All import material must comply with DTSC recommendations and guidelines for environmentally clean soil suitable for school construction. Import testing will be provided and paid for by the Owner.

1.10 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of GENERAL CONDITIONS and DIVISION 1, GENERAL REQUIREMENTS.
- B. Accurately record actual locations of utilities encountered including depth and horizontal location, as measured from permanent site features.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill in Turf or Other Planting Areas: Type S2 or S3 per Division 31 Specification Section SOIL MATERIALS.
- B. Fill in Non-planting Areas: Type S1, S2 or S4 per Division 31 Specification Section SOIL MATERIALS.
- C. Imported material: Type S3, S4 or S5 per Division 31 Specification Section SOIL MATERIALS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.

3.2 PREPARATION

- A. Layout of Work:
 - 1. Contractor shall be responsible for all lines and grades. Layout shall be provided by a California registered Land Surveyor or Civil Engineer, at Contractor's expense.
 - 2. Check all benchmarks, monuments and property lines and verify locations.
 - 3. Locate and maintain all grade stakes.
 - 4. Monuments moved or displaced during grading operation are to be replaced by a

California Registered Civil Engineer or Surveyor, at Contractor's expense.

- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- D. Protect existing structures, fences, curbs, sidewalks, paving and other improvements to remain from damage from excavation equipment and vehicular traffic.
- E. Employ equipment and methods appropriate to the work site.
- F. Protect excavated areas from drainage inflow and provide for drainage of all excavated areas.
- G. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.3 SITE STRIPPING:

- A. Reference is made to Division 31 Specification Section SITE CLEARING.
- B. Within the areas of planned surface improvements and structures, the near surface soils containing vegetation, roots, organics, or other objectionable material must be stripped and removed from the site. Upon approval of the Geotechnical Engineer, suitable materials stripped from the site may stockpiled and incorporated into the finish fill for planting areas.
- C. All areas to receive surface improvements shall be stripped to remove turf, shrubs, trees and other vegetation, along with associated root systems, concrete, wood, metal, rubbish and other unsuitable debris, and any loose, saturated or unconsolidated soil material. Minimum stripping depth is expected to be 3-inches below existing site grades. Stripping shall continue to the depth required to expose acceptable basement soils that are free from deleterious which are not suitable for Engineered Fill, as required by the Geotechnical Engineer.
- D. Soil distributed as a result of demolition, undocumented fill deemed to possess inadequate compaction or uniformity, debris, and abandoned underground structures must be excavated to expose undisturbed native soil or suitable fill.

3.4 EXCAVATION

- A. Following clearing and stripping operations, excavate planned construction areas as specified in this Section.
- B. Within the area of the planned building improvements plus at least 5 feet horizontally beyond the perimeter of these improvements, the subgrade must be over-excavated at least 12 inches below the stripped subgrade surface or 12 inches below the proposed foundations, whichever is deeper.
- C. Areas of exterior concrete slabs on grade located outside the building pad over-excavation limits, should be prepared by scarification of the upper 12-inches below existing grade or 12-inches below the bottom of the recommended aggregate base section, whichever is greater. The zone of subgrade preparation should extend a minimum of 5 feet beyond these improvements. These soils should be moisture conditioned to slightly above optimum and compacted as engineered fill.

- D. Areas of asphalt concrete improvements should be prepared by scarification of the upper 12-inches below existing grade or 12-inches below the recommended base section, whichever is greater. These soils should be moisture conditioned to slightly above optimum and compacted as engineered fill.
- E. Provide additional excavation as required to conform to the lines, grades and cross-sections shown on the plans.
- F. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw. Remove all roots $\frac{1}{2}$ " in diameter and greater.
- G. Remove excess soil not to be used as fill in the Work from the site. Unless requested by Owner to be deposited at a site designated by Owner on the property, obtain a disposal site and legally dispose of said excess material, all at no additional cost to the Owner.
- H. Areas disturbed by demolition must be excavated to expose undisturbed soils.
- I. Excavated soils free of deleterious substances (organic matter, demolition debris, tree roots, etc.) and with less than 3% organic content by weight (ASTM D2974), may be returned to the excavations as Engineered Fill.

3.5 FILLING AND COMPACTING

- A. Once clearing, stripping and over-excavation operations are complete, proof-roll under the observation of the Geotechnical engineer to detect soft or pliant areas. Soft or pliant areas must be over-excavated to firm native soil.
- B. Place and compact soil to finish subgrade of improvements to be placed thereon, or to finished surface grade where no improvements are to be placed thereon.
- C. All fill required shall be placed as Engineered Fill.
- D. The Contractor shall be solely responsible for securing an acceptable source of import material as required to grade the site. Reference is made to 31 20 00 1.9.H
- E. On-site soils are suitable for re-use as Engineered Fill, providing they are cleansed of excessive organics (less than 3 percent by weight, ASTM D2974), debris, and fragments larger than three (3) inches in maximum dimension and meet the requirements of soil Type S4, Division 31 Specification Section SOIL MATERIALS.
- F. Engineered Fill shall be moisture conditioned to at or above optimum moisture, placed in uncompacted layers not exceeding eight (8) inches in thickness, and compacted as specified, based on ASTM Test Method D1557.
 - 1. Non-vegetative surface improvement areas (structures and site concrete improvements) - To a minimum of 90% of maximum dry density (relative compaction).
 - 2. Vegetative surface improvement areas (turf and planters) - Below top twelve (12) inches - to a minimum of 90% of maximum dry density (relative compaction). Top twelve (12) inches - 85% of maximum dry density (relative compaction).
 - 3. Pavement areas: to a minimum 95% of maximum dry density (relative compaction) in top twelve (12) inches.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Additional lifts shall not be placed if the previous lift did not meet the required dry density (relative compaction), or if soil conditions are not stable.

- I. Conform fill to the lines, grades and cross-sections shown on the plans.
- J. Fill materials to conform to Division 31 Specification Section SOIL MATERIALS.
- K. Provide, at no additional cost to Owner, imported soil material conforming to the requirements of Division 31 Specification Section SOIL MATERIALS, as needed to attain finished grades of Work.
- L. Utilize equipment which will not disturb or damage existing utilities and other improvements.

3.6 PREPARATION OF SUBGRADE FOR SURFACE IMPROVEMENTS

- A. Where concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvements, or a layer of said surface improvements, are to be constructed on the soil surface, prepare the subgrade for said improvements in accordance with Section 3.4.
- B. Scarify the soil as specified and remove and dispose of (off the project site) all rocks, hardpan chunks or otherwise unsuitable material over 3-inches in size.
- C. Thoroughly moisture condition and compact as described above.
- D. Prior to commencing construction of surface improvements, pass a test roller of size and weight as approved by the Owner over the subgrade to establish the extent of soft or spongy areas requiring repairs.
- E. Conform finished subgrade surface to the lines, grades and cross-sections shown on the plans.

3.7 FINE GRADING

- A. Fine grade all finished surfaces to the lines, grades and cross-sections shown on the plans, and to blend to hard surface improvements.
- B. Rake and smooth all finished surfaces not to receive hard surface improvements.
- C. Use suitable stockpiled or imported topsoil for the top 12-inches of areas to receive landscape improvements.
- D. Import topsoil meeting the requirements of Division 31 Specification Section SOIL MATERIALS, as required to complete finish grading.
- E. Topsoil may not be used in areas requiring Engineered Fill.

3.8 TOLERANCES

- A. Top surface of Subgrade for Non-Vegetative Surface Improvements or Layers thereof: Plus or minus 0.02 foot from planned elevation.
- B. Top surface of Subgrade for Vegetative Surface Improvements or for Bare Ground - Plus or minus 0.05 foot of planned elevation, or as required for finish surface to match adjacent improvements or ground.

3.9 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of GENERAL CONDITIONS and/or DIVISION 1, GENERAL REQUIREMENTS.

- B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.
- D. All retesting required as a result of failure of initial test will be performed by Owner's testing agency, at the expense of the Contractor.

3.10 PROTECTION

- A. Protect graded areas from traffic, freezing, erosion, and all other sources of damage. Keep free of debris and trash.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed work becomes eroded, rutted, settled, or where it is damaged by subsequent construction operations or weather.
- C. Where settlement occurs prior to acceptance of the work, remove and replace surface improvements, excavate, replace, and re-compact in accordance with these specifications, and restore the surface improvements.

3.11 CLEANING

- A. Remove all surplus or unsatisfactory soil material, trash, and debris, and legally dispose of off of the Owner's property.

END OF SECTION 31 20 00

SECTION 31 22 22
SOIL MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY:

- A. SECTION INCLUDES
 - 1. Excavated (and re-used) materials and imported materials.

1.3 RELATED SECTIONS:

- A. Section 312000 - Earthwork: Excavation, Filling and Grading
- B. Section 312333 - Trench Excavation and Backfill

1.4 SUBMITTALS

- A. Samples: Submit, in air-tight containers, 10 lb. sample of Type S3, S4 and S5 fill to inspector.
- B. Soil Analysis: Submit for Type S3, S4 and S5 soils to be imported.
- C. Materials Source: Submit location of imported materials source. Provide materials from same source throughout the work. Change of source requires approval.
- D. For imported soil, obtain Geotechnical Engineer and District approval prior to importing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Soil Type S1: Excavated and re-used material, graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- B. Soil Type S2: Excavated and reused material, graded; free of roots, lumps greater than one inch, rocks larger than 1/2 inch, debris, weeds and foreign matter.
- C. Soil Type S3: Imported topsoil, friable loam; reasonably free of roots, rocks larger than 1/2 inch, debris, weeds, and foreign matter.
- D. Soil Type S4: Imported borrow, suitable for purposes intended, meeting the following characteristics:
 - 1. Maximum Particle Size: 3"
 - 2. Percent Passing #4 Sieve: 65-100
 - 3. Percent Passing #200 Sieve: 20-45
 - 4. Expansion Index: <20
 - 5. Plasticity Index: <12
 - 6. R-Value (in paved areas): >50

- 7. Low Corrosion Potential:
 - a. Soluble Sulfates: <1,500 mg/Kg
 - b. Soluble Chlorides: <300 mg/Kg
 - c. Soil Resistivity: >2,000 ohm-cm
- E. Soil Type S5: Imported sand. Natural river or bank sand (sand equivalent greater than 30), washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.2 SOURCE QUALITY CONTROL

- A. Inspection of imported soil will be performed by the Geotechnical Engineer, at source of import and prior to being delivered to the site.

PART 3 - EXECUTION

3.1 STOCKPILING

- A. Stockpile excavated or imported material onsite at location designated by project inspector.
- B. Stockpile excavated or imported material in sufficient quantities to meet project schedule and requirements.

3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.
- B. Dispose of excess material off-site.

END OF SECTION 31 22 22

SECTION 31 23 33 TRENCH EXCAVATION AND BACKFILL

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.
- B. Geotechnical Report prepared by BSK Associates Engineers and Laboratories, Project number G00001118, dated July 14, 2023.

1.2 SUMMARY:

- A. SECTION INCLUDES
 - 1. Excavating trenches, holes and pits for constructing the Work.
 - 2. Backfill and compaction.
 - 3. Providing suitable bedding and backfill material, as specified herein.
- B. RELATED SECTIONS
 - 1. Contract General Conditions and Division 1, General Requirements.
 - 2. Section 311100 - Site Clearing
 - 3. Section 312000 - Earthwork: Excavation, Filling and Grading
 - 4. Section 312222 - Soil Materials
 - 5. Section 331200 - Water Utilities
 - 6. Section 333000 - Site Sewer Systems
 - 7. Section 334000 - Storm Drainage

1.3 REFERENCES

- A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

1.4 DEFINITIONS

- A. Utility: Any buried or above ground pipe, conduit, cable, associate devices or appurtenances, or substructure pertaining hereto.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Installer:
 - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.
- B. Regulatory Requirements:
 - 1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:
 - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
 - b. CM City of Madera, Codes and Ordinances
 - c. EPA Environmental Protection Agency.

- d. CAL/OSHA Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.
- C. Certificates:
- 1. Installer's certification that all trench backfill installation meets or exceeds the requirements of this specification.
 - 2. Contractor's certification (on Contractor's letterhead paper) that the trench backfill materials and installation meets or exceeds the requirements of this specification.
- D. Meetings:
- 1. Pre-Installation: Schedule prior to the start of work.
 - a. Coordinate the work with other work being performed.
 - b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
 - 2. Progress: Scheduled by the Contractor during the performance of the work.
 - a. Review for proper installation of work progress.
 - b. Identify any installation problems and acceptable corrective measures.
 - c. Identify any measures to maintain or regain project schedule if necessary.
 - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
 - a. Inspect and identify any problems which may impede issuance of warranties or guaranties.
 - 4. Maintain installed work until the Notice of Substantial Completion has been filed.

1.6 COORDINATION

- A. Coordinate work with Owner's personnel.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities.

1.7 EXISTING UTILITIES

- A. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete work, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- B. Under circumstance similar to 31 23 33/1.7A, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. Determine exact location of existing buried utilities by:
 - 1. Marking on ground or pavement surface the alignment and extent of the proposed facilities and the probable location of existing utilities using construction plans and existing surface features.
 - 2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations, and notify Owner of said request concurrently.

3. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.
- D. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.
- E. Provide Field Engineering per Contract General Conditions and Division 1 to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under the Contract, submit detailed information to the Owner's Inspector and Engineer for review and direction.
- F. Maintain all existing utility mains and service lines in constant service during construction of the Work.
- G. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Fill Type S1, S2, S4 and S5, as specified in Division 31 Specification Section SOIL MATERIALS.

2.2 WARNING TAPE

- A. 6" wide warning tape shall be installed over all of the pipelines as shown on the details.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- B. Protect existing structures, fences, sidewalks, curbs, and other improvements from excavation equipment and vehicular traffic.
- C. Maintain and protect above and below grade utilities which are to remain.
- D. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.2 EXCAVATION

- A. Excavate soil required to locate existing utilities and install the work.
- B. Use hand methods of excavation to locate existing utilities, and to excavate trenches, pits and holes in congested areas.

- C. Employ equipment and methods appropriate to the work site. Small mechanical excavators may be used only in areas where there is sufficient space so as not to damage adjacent improvements, and where the locations of all existing utilities have been determined by hand methods of excavating.
- D. Cut trenches just wide enough to enable installation and proper bedding and backfill, and to allow inspection.
- E. Do not interfere with 45 degree (1:1) bearing splay of foundations.
- F. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose material.
- G. Excavate trenches, pits or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings, and then backfill to the pipe grade with Type S2 or S5 material, containing sufficient moisture to allow compaction to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5. No additional payment will be made for such over-excavation and refill.
- H. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure, and backfill the space with Type S2 or S5 material containing sufficient moisture to allow compaction to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5. No additional payment will be made for such additional excavation or backfill.
- I. Excavate trenches to provide the design grade of the facility, or as directed by the Engineer.
- J. Stockpile excavated material to be returned to trench adjacent thereto in location which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove from site all unsuitable or excess material not to be used.
- K. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.
- L. Remove excess soil not used as backfill from the work site. Obtain a disposal site off of the Owner's property and legally dispose of said excess material, all at no additional cost to the Owner.
- M. If water is encountered during excavations, provide all dewatering measures necessary to construct improvements shown.
- N. Contractor shall make all provisions necessary, including but not limited to, shoring or sloping back trench walls as required to address sandy soils. The cost of these provisions shall be included in the lump sum amount bid for this work and no separate payment will be made therefore.

3.3 PROTECTION OF EXCAVATIONS

- A. Provide all shoring and bracing as required and those codified in local, state and federal safety regulations.
- B. Prevent water, caving or sloughing ground from entering excavations.
- C. Maintain excavations free of water.

3.4 BACKFILLING

- A. Provide type S2 or S5 pipe bedding as required by Plans and compact to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5.
- B. After installation of pipes and appurtenances and placement of pipe bedding material, backfill trenches and excavations to finished grade, or subgrade in areas to receive surface improvements
- C. Backfill trenches above pipe bedding material and to within 24 inches of finish subgrade with Type S1, S2, S4, or S5 soils, except that that top 12 inches shall be type S2, S3, S4, or S5 soils.
- D. Employ a placement method that does not disturb or damage existing or proposed pipes or other Utilities or Improvements.
- E. Place and compact all soil backfill in continuous layers not exceeding 8 inches in loose uncompacted thickness, moisture condition to within 2% above optimum moisture content.
- F. Maintain optimum moisture content of fill materials to attain required compaction.
- G. Backfill final 12-inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with Type S2, S4, or S5 soils.
- H. Backfill final 12-inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil, with Type S2 or S3 soils.
- I. Compact backfill below the top 12-inches to 90% maximum dry density (relative compaction).
- J. In areas to receive buildings, structures, or concrete flatwork, compact the top 12-inches to 90% maximum dry density (relative compaction).
- K. In areas to receive asphalt concrete pavement or concrete pavement subject to vehicular traffic, compact the top 12-inches to 95% maximum dry density (relative compaction).
- L. In planting areas, compact the top 12-inches to 85% maximum dry density (relative compaction).

3.5 TOLERANCES

- A. Top Surface of Backfill under Paved or Concrete Areas: Plus or minus 0.02 feet from required elevations.
- B. Top Surface of General Backfilling: As required for finish surface to match adjacent improvements or ground.

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of General Conditions and/or Division 1.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.
- C. If tests indicate work does not meet specified requirements, recompact, and retest. Retests required due to failure of initial tests shall be paid for by the Contractor.

3.7 PROGRESS AND PROSECUTION

- A. Backfill any excavation opened in any day on that same day.

END OF SECTION 31 23 33

SECTION 31 31 00
SOIL TREATMENT

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements including but not limited to:
 - 1. Soil treatment for termites.
 - 2. Accessories necessary for a complete application.
- B. Related Sections:
 - 1. Section 01 57 15: Integrated Pest Management.

1.3 SUBMITTALS

- A. Product Data: Technical data for each type of termite control product including the EPA Registered Label.
- B. Qualification Data: Submit Installer's qualifying data.
- C. Warranties.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA Registered Label.
- B. Installer Qualifications: A specialist having minimum 5 years documented experience who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- C. Source Limitations: Obtain termite control products from single source from single manufacturer.

1.5 WARRANTY

- A. Soil Treatment Warranty - Written warranty signed by Applicator and Contractor, certifying that termite control work, consisting of workmanship and applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, retreat soil and repair or replace damage caused by termite infestation:
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide - Provide an EPA Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label:
 - 1. Products - Subject to compliance with requirements, provide one of the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Prevail.
 - 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for moisture content of soil in accordance with termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application after correcting unsatisfactory conditions.

3.3 PREPARATION

- A. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation - Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer:
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.4 APPLICATION

- A. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA Registered Label for products.

3.5 APPLYING SOIL TREATMENT

- A. Application - Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly:
 - 1. Slabs on Grade and Basement Slabs: Underground supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground supported slabs are installed. Use waterproof barrier according to EPA Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 31 00

**SECTION 31 31 16
UNDER-SLAB TERMITE/VAPOR BARRIER**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Products supplied under this section:
 - 1. Termite Control/Vapor barrier and accessories for installation under concrete slabs.
- B. Related sections:
 - 1. Section 03 30 00: Cast-in-Place Concrete.
 - 2. Section 07 26 00: Under-Slab Vapor Barrier.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E1745: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - 2. ASTM E1643: Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
 - 1. ACI 302.2R Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.4 SUBMITTALS

- A. Quality control/assurance:
 - 1. Summary of test results per paragraph 9.3 of ASTM E1745.
 - 2. Summary of independent testing documenting laboratory and in-field termite resistance testing.
 - 3. Manufacturer's samples and literature.
 - 4. Manufacturer's installation instructions for placement, seaming, penetration repair, and perimeter seal per ASTM E1643 and any additional procedures to account for subterranean termite protection.
 - 5. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Termite/Vapor barrier shall have all of the following qualities:
 - 1. Maintain permeance of 0.01 Perms [grains/(ft² · hr · inHg)] or less as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 - 2. Other performance criteria:

- a. Puncture Resistance per ASTM D4833: 137 Newtons.
 - b. ASTM E1745 Class C Minimum.
 - c. Thickness: 15 mils minimum.
3. Provide documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
- B. Termite/Vapor barrier products:
 1. Basis of Design: **Pango Wrap Termite/Vapor Barrier** (15-mil) marketed by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.
 2. No substitutions.

2.2 ACCESSORIES

- A. Seams:
 1. Pango Tape marketed by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- B. Penetrations of Termite/Vapor barrier:
 1. Pango Tape marketed by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- C. Perimeter/edge seal:
 1. Pango Claw marketed by Stego Industries LLC, (887) 464-7834 www.stegoindustries.com.
- D. Penetration Prevention:
 1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- E. Vapor Barrier-Safe Screed System:
 1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer:
 1. Level and compact base material.

3.2 INSTALLATION

- A. Install vapor barrier in accordance with ASTM E1643 and manufacturer's instructions:
 1. Unroll Pango Wrap Termite/Vapor Barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend Pango Wrap to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise at a point acceptable to the structural engineer.
 3. Seal Pango Wrap to slab using Pango Claw, per manufacturer's instructions.
 4. Overlap joints a minimum of 6 inches and seal with manufacturer's seam tape.
 5. Apply Pango Tape and Pango Claw to a clean and dry membrane
 6. Seal all penetrations (including pipes) per manufacturer's instructions.
 7. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier

8. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
9. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
10. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.
11. Repair damaged areas by cutting patches of Pango Wrap Termite/Vapor Barrier, overlapping damaged area a minimum of 6 inches and taping all sides with Pango Tape.

END OF SECTION 31 31 16

**SECTION 32 01 90
EXISTING LANDSCAPE PROTECTION**

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This Section includes but is not limited to the following:
 - 1. Protection and maintenance of existing trees and other plants that are affected by the execution of the Work, whether temporary or new construction.
 - 2. Boxing, moving, maintaining and replanting existing trees scheduled to be relocated.
- B. Related Work Specified Elsewhere
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections
 - 2. Section 31 11 00 - Site Clearing
 - 3. Section 31 20 00 - Earthwork
 - 4. Section 31 23 33 - Trench Excavation and Backfill
 - 5. Section 32 84 00 - Irrigation System
 - 6. Section 32 90 00 - Landscape Planting

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated or proposed for use.
- B. Qualification Data: Submit arborist's certification and/or license information. Submit qualifications and experience of the certified tree worker if not the arborist.
- C. Project Certification: Provide a certification letter from the consulting arborist that trees indicated to remain have been protected during construction according to these specifications and/or the arborist's recommendations, and provide a list of any trees damaged during construction and the subsequent treatment and repair.
- D. Transplanting and Maintenance Recommendations: Submit transplanting, maintenance and protection specifications from a qualified arborist for care and protection of trees during and after completion of the Work that are likely to be affected by construction operations. The tree maintenance recommendations shall be included in the Maintenance Manuals required in 329000.
- E. Tree Assessment and Valuation: Prior to the start of any construction operations of any kind, submit a tree assessment including tree valuation for existing trees scheduled to remain in the area of work or in auxiliary construction areas.
 - 1. Tree valuation for trees species that do not have comparable and available replacement sizes shall be determined by a certified consulting arborist experienced in tree valuation using the "Guide for Establishing Values of Trees and Other Plants", current edition, published by the International Society of Arboriculture, Urbana, Illinois.
 - 2. Tree assessment shall include a physical description, health, condition and recommended pruning and/or mitigation measures based on the expected construction operations to minimize the negative impacts to the affected trees.

1.3 QUALITY ASSURANCE

- A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and/or relocation work similar to that required for this Project, and who will provide experienced, certified tree workers.
- B. Arborist Qualifications: The arborist shall be certified by the International Society of Arboriculture. If the arborist is performing tree work, he/she shall be employed by a licensed contractor, or shall hold an individual license if independent.
- C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated or recommended by the certified arborist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: See Section 32 93 00.
- C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers, minimum 4.8 oz/sq. yd.
- D. Temporary Fencing: Heavy-duty exterior rated plastic or chain link fencing, minimum four feet high with stakes at a maximum 10 feet on-center or as needed for a taut installation.
- E. Wood mulch: Walk-on type chipped wood and aged greenwaste material without leaves, green wood, sticks, dirt, dust, construction materials and other debris. Particle size 1/2" to 3" in general size.
- F. Coarse sand: Clean sand with greater than 95% passing a #10 sieve, less than 5% passing a #30 sieve, and less than 1% passing a #50 sieve.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing located around the canopy drip line of trees (the tree protection zone [TPZ]), and around the plants scheduled to remain that are inside the construction area. The TPZ fence layout shall be reviewed for acceptance by the Owners Representative and the consulting arborist.
- B. All work within the TPZ shall be reviewed and monitored by the consulting arborist.
- C. Within the TPZ, install a 4 inch depth of wood mulch over a permeable filter fabric with minimum 4 inch overlaps at fabric seams. Remove the protection mulch and fabric prior to any cultivation and amendment tillage.
- D. Provide a temporary dirt berm watering basin around trees and plants scheduled to remain. The berm around trees shall be a minimum diameter of six times (6x) the diameter of the tree at breast height (DBH), or not less than six feet in diameter, whichever is greater.

- E. Provide temporary irrigation or a portable water source to irrigate trees and plants scheduled to remain. Irrigate at minimum once a week or more often as necessary to moisten soil to a minimum 18 inch depth for trees, and a minimum depth of 12 inches for shrubs. Reapply irrigation based on an evapotranspiration loss of 50%.
- F. Protect plant/tree root systems within the protected fenced areas from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- G. Do not store construction materials, debris, or excavated material within the TPZ. Do not permit vehicles or reoccurring foot traffic within the TPZ to prevent soil compaction over root systems.
- H. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

- A. Do not excavate within the canopy drip line of existing trees unless otherwise authorized. Any excavation within the TPZ shall be performed under the onsite monitoring by the consulting arborist.
- B. Where excavation for new construction and/or utility lines are required within the canopy drip line of trees, hand clear and excavate to minimize damage to root systems. Use spading forks to comb soil or use an Air-Spade to expose roots.
- C. Where utility lines are to be located within the drip line of trees, expose the existing root system to the depth of utility line installation plus the depth of any required bedding material. Place piping below and/or through the exposed roots without damage to the root system. Backfill with approved material and compact by flooding the area if allowed.
- D. As an alternative to manual or Air-Spade trench excavation, utility or other below grade piping may be mechanically bored under the crown dripline with a minimum cover of 3 feet as authorized by the consulting arborist.
- E. Root Pruning: Do not cut main lateral roots or taproots greater than one inch in diameter. Smaller roots less than one inch in diameter that interferes with the installation of new improvements and/or utility lines may be cut only if absolutely necessary. Only cut roots with sharp pruning instruments; do not break, tear or chop. Block out concrete footings around roots greater than one inch diameter leaving a minimum one inch clearance around roots to remain. Provide alternative footing design if main lateral roots are in conflict.

3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by the certified arborist, unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots less than one inch diameter. Cut roots with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 12 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required

finish elevations. Do not place fill greater than 6 inches in depth within 24 inches of the trunk, and do not cover the trunk/root base flare. Do not allow standing water at the trunk.

- C. Moderate Fill: Where existing grade is more than 12 inches , but less than 18 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of existing grade and extend not less than 20 inches from tree trunk on all sides up to the finish grade. Slope of the rock fill shall be a maximum 2h:1v. For balance of area within drip-line perimeter, place drainage fill a minimum 6 inches in depth.
 2. Place filter fabric over the drainage fill with edges overlapping 6 inches minimum.
 3. Place fill layer of topsoil to finish grade. Do not mechanically compact drainage fill or topsoil more than 85% relative density in planted areas. Hand grade to required finish elevations.

3.4 TREE PRUNING

- A. Prune remaining trees affected by temporary and new construction only when authorized by the Landscape Architect and as recommended by the consulting arborist.
- B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system only when authorized by the Landscape Architect and as recommended by the consulting arborist. Provide subsequent maintenance during Contract period as recommended by the consulting arborist.
- C. Pruning Standards: Prune trees according to ANSI A300 based on pruning for access clearance, to correct any defects in structure, or to remove potential conflicts with new improvements. Pruning shall only be performed by a Certified arborist or tree worker.
- D. Cut branches with sharp pruning instruments; do not break or chop. Clean pruning tools with a diluted bleach solution prior to performing any pruning operations.

3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the arborist.
- B. Remove and replace dead and/or damaged trees impacted by the construction operations that the arborist determines to be incapable of restoring to a normal growth pattern.
1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in 32 90 00.
 2. When new trees of the same size and species are not available, furnish and install the largest size boxed tree that is readily available and will successfully grow in the planting area with long term health and without damage to adjacent improvements. Credit the Owner the difference between the valuation of the removed existing tree and the installed replacement tree.
- C. Aerate surface soil within any existing Oak tree dripline compacted before or during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 18 inches deep at 36 inches o.c. Backfill holes with coarse sand. Manually till the top 4 inches with a spading fork, and break up clods greater than 1 inch diameter. Smooth grade prior to installing wood mulch.

3.6 TRANSPLANTING TREES FOR RELOCATION

A. Preparation

1. Follow the transplanting recommendations of the consulting arborist and these specifications. If conflicting directions are present, notify the Landscape Architect for a resolution. If no notice is given, follow the most strict and/or costly option.
2. A light thinning of the tree canopy shall be performed prior to boxing to reduce the leaf area by approximately 10 – 15 percent, and to remove any dead wood. Pruning shall be performed under the direction of a certified arborist, and shall comply with ISA Pruning Standards (ANSI 300).
3. Surrounding pavement shall be sawcut and removed as needed for boxing operations.
4. Ensure adequate soil moisture around the rootball so that no soil breaks away from the rootball during side boxing operations.

B. Boxing

1. The box dimensions shall be a square of a minimum of 6 times the diameter (caliper) of the tree trunk at 12 inches above the existing grade. In all cases, the box dimension shall not be less than 24 inches.
2. Excavate by hand around the sides of the tree for the top 12 inches of soil, or until the majority of the lateral roots have been severed. Rough excavate by machine to the required depth. Final rootball shaping shall be performed by hand. All root pruning shall be cut clean and square with pruning loppers or pruning saw. Treat all severed root ends with an antidesiccant to diminish root transpiration.
3. The box sides shall be securely fastened with horizontal metal bands, and all voids filled. Following side boxing, the tree shall remain in place a minimum of 4 weeks. Provide a minimum 3 inch depth of wood mulch on the top surface of the box. Maintain adequate soil moisture in the rootball.
4. After the acclimation period, the tree shall be undercut and bottom boxed. Securely fasten the bottom panel with vertical metal bands running on all four sides of the box. Secure the crane cable around and/or under the tree box in order to lift the tree out of the ground. The Contractor is responsible to ensure the box is constructed to withstand the weight of the watered tree and the stress of moving.
5. The relocated trees shall be moved with equipment rated for the size and weight of the boxed tree. The Contractor is responsible for all expenses related to the moving, storage, planting and maintenance of the relocated tree.
6. The void of the removed tree shall be backfilled with one of the following:
 - a. Engineered fill per the Earthwork specification in a proposed hardscape area, or area underneath structures.
 - b. Planting topsoil per the Landscape Planting specification in a proposed planting area.

C. Maintenance and Replanting

1. If necessary, temporarily store the tree out of the immediate construction zone but inside the construction fenced area. Provide a temporary irrigation source and a regular irrigation schedule.
2. Prepare the new planting pit and plant the tree per the approved planting detail and specifications. Maintain the watering berm for as long as possible when in a turfgrass area.

3.7 CLEAN-UP

- A. Burning is not permitted.
- B. Prior to Final Acceptance, remove the TPZ fence, stakes and other related materials.
- C. Legally remove excess excavated material, debris, displaced trees, and greenwaste from Owner's property. Broom clean all hardscape surfaces in the area of work.

END OF SECTION 32 01 90

SECTION 32 11 26
AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Provide all material, labor, equipment and services necessary to install aggregate base surfacing as indicated by the Contract Documents.

1.3 RELATED SECTIONS

- A. All Division 00 Specification Sections
- B. All Division 01 Specification Sections
- C. Section 312000 – Earthwork: Excavation, Filling, and Grading
- D. Section 312333 – Trench Excavation and Backfill
- E. Section 321216 – Soil Sterilization
- F. Section 321217 – Asphalt Paving
- G. Section 321313 – Site Concrete Improvements

1.4 REFERENCES

- A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials

1.5 QUALITY ASSURANCE

- A. Provide and install in accordance with SSCDOT.

1.6 SUBMITTALS

- A. Submit data sheets from supplier to document compliance with SSCDOT requirements.
- B. Certificates of compliance for material.
- C. Load tags for delivered material.

1.7 COORDINATION

- A. Coordinate with other work, including subgrade preparation and soil sterilization.
- B. Coordinate installation schedule with Owner's use of the premises and with other contractors working at the site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aggregate Base: Unless specified otherwise on Plans, Class 2, 3/4 Inch Maximum per Section 26 of SSCDOT.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify quantities required.
- B. Verify that subgrade has been placed and compacted per Contract Documents
- C. Verify gradients and elevations of subgrade are correct.

3.2 INSTALLATION OF AGGREGATE BASE COURSE

- A. Install in conformance with SSCDOT Section 26, Aggregate Bases.
- B. Thickness - As shown on construction drawings.
- C. Spreading and Compacting - In accordance with Section 26, SSCDOT. Base course shall be moisture conditioned to within 2% of optimum moisture, placed in uncompacted layers not exceeding six (6) inches in thickness, and compacted as specified, based on ASTM Test Method D1557. The relative compaction of each layer of compacted base material shall be not less than 95 percent.
- D. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities, true to grade and cross-section.
- E. Lines and grades for the installation of aggregate base shall be set by a California licensed Land Surveyor or Civil Engineer, at Contractor's expense.

3.3 TOLERANCES

- A. Compacted thickness of aggregate base: Not less than the thickness specified on the Plans.
- B. Finished Surface: Within 0.02 foot of planned grade per Section 26, SSCDOT. No more than 50% of the finish surface shall be above or below the specified grade for aggregate base.

3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed by the Owner's inspector, under provisions of Division 01.

3.5 PROTECTION

- A. Immediately after placement and compaction, protect surface from mechanical injury.
- B. Protect completed surface until surfacing layers are in place.

END OF SECTION 32 11 26

SECTION 32 11 30 SYNTHETIC TURF

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install track and field in-ground and other equipment.
- B. Section Includes
 - 1. Permeable aggregate base and fine aggregate leveling layer
 - 2. Geotextile liner
 - 3. Composite wood nailer at the perimeter concrete edge and corn boxes
 - 4. Shock Pad
 - 5. Synthetic turf carpet with tufted polyethylene and nylon fibers
 - 6. Organics/Sand infill system
 - 7. Grooming machine
- C. Related Sections:
 - 1. Section 31 22 00 – Earthwork
 - 2. Section 31 23 16 – Trench & Backfilling
 - 3. Section 33 41 11 – Storm Drainage Systems
 - 4. Section 32 11 26 – Aggregate Base

1.2 SUMMARY

- A. The work under this section shall consist of furnishing all labor, materials, and equipment necessary to install, in place, the base layer to receive the geotextile liner, shock pad and synthetic turf, and other materials as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with these specifications, the turf provider's instructions and in accordance with all details and shop drawings.

1.3 SUBMITTALS

- A. Substitutions: AstroTurf RootZone 3D360 Blend Trionic is a standard of quality.
 - 1. Provide all specifications, product data, certification and required information for proposed alternate. It is the responsibility of the bidder to prove that the product substitution is equal to or greater than the product listed as the "standard of quality".
 - 2. Provide a sample copy of insured warranty and insurance policy information
 - 3. Provide a sample (8.5" x 11") of the product substitution
- B. Product Data: For each type of product indicated.
 - 1. Submit catalog cuts, material safety data sheets (MSDS), brochures, specifications, preparation and installation instructions and recommendations.
 - 2. All supplied and installed materials and products will meet or exceed the minimum specifications designated in this section. Sufficient data must be submitted to indicate compliance with the Contract Documents.
 - 3. Submit instructions for installation.
- C. Test Results: The following test results, certified by a licensed independent testing laboratory, shall be submitted as outlined below
 - 1. With the bid – Mandatory and minimum specifications as shown in Part 2. Bids not meeting the minimum specifications will be rejected.

2. Upon completion of the installation of the infill (including anti-static applications)— Installer Supervisor must measure and record infill depth using a three-prong depth tester for Turf and Tracks with analog or digital readout. At ten separate field locations, three data points should be recorded by measuring the infill depth in a triangular pattern approximately 12" – 18" apart. At each of the ten testing locations, the three data points should be averaged.
 3. At completion of project – Dynamic Cushioning Test according to ASTM F-355-95, Procedure A and Standard F-1936-98 only if the finished product is to be used for American Football.
- D. Shop Drawings: Show fabrication and installation details for synthetic turf including, but not limited to:
1. Proposed locations of all seams in fabric surfacing. Show installation methods and construction.
 2. Field lining and marking - Submit a complete scale and dimensional drawing of inlaid or tufted-in field lines and marking boundaries. Include graphics for end zones and center logo artwork for approval as well.
 3. All submittals shall be provided within 7 days after Notice to Proceed
 4. Indicated on shop drawings the pre-fabricated inlay's that will be factory installed. Center hash marks, numbers, arrows and endzone lettering.
- E. The Turf Manufacturer shall provide the following samples of the artificial turf selected for this project
1. An 8.5" x 11" minimum sample of the exact synthetic turf and infill system that is specified for this project.
 2. Infill mix in accordance with product specifications
- F. Turf Manufacturer Certificates: Certified list of fifty (50) existing installations of a synthetic turf and infill system within the last three years, including Owner Representative and telephone number, attesting compliance with quality assurance information. All must be located within the continental United States.
- G. With the bid - Proof that the Turf Manufacturer is a member, in good standing, of the Synthetic Turf Council
- H. With the bid – Sample Warranty: Provide a sample pre-paid third party insured warranty with the bid. Policy must be in force at the time of the bid.
1. The Contractor shall provide a warranty to the Owner that covers defects in materials and installation workmanship of the turf for a period of eight (8) years from the date of substantial completion. The turf provider must verify that their representative has inspected the installation and that the work conforms to the turf provider's requirements and any written directives. The warranty shall include general wear and damage caused from UV degradation. Other items that must be addressed include the following:
 - a. Acceptable uses for the field
 - b. Fading
 - c. Color match within specifications
 - d. Excessive fiber wear
 - e. Wrinkling and panel movement
 - f. Shock absorbency (Gmax)
 - g. Seam integrity
 - h. Drainage (through the turf only)
 2. Exclusions shall include the following:
 - a. Vandalism
 - b. Acts of God

3. The warranty shall be fully third-party insured for the entire 8-Year term and be non-prorated. Warranties that include language which pro-rates benefits shall cause the provider's bid to be rejected. Prior to final payment for the synthetic turf, the Contractor shall submit to the Owner, this policy guaranteeing the warranty to the Owner. Insurance must reflect the following values:
 - a. \$10,000,000.00 per each insured warranty
 - b. \$15 Million dollar annual aggregate for all warranties issued during each 12 month period of the 8-Year warranty
 - c. Policies that are backed by a Letter of Credit are not acceptable
 - d. Policy must be issued by an A- rated or greater A.M. Best Rating
 - e. Policies that include self-insurance or self-retention clauses shall not be considered. Policy can not include any form of deductible amount. Policy must be in force at the time of the bid.
- I. With the bid – Turf Manufacturer must attest that their submitted products do not infringe on any known patents.
- J. Maintenance and Operations Data: At the completion and acceptance of the project submit 3 complete sets, in manual form, of all the turf provider's recommended procedures and materials for, but not limited to general maintenance, line/marketing installation, small repair procedures, cleaning, etc.
- K. Project Record Documents: Record actual locations of seams, drains, and other pertinent information in accordance with the General Requirements.

1.4 QUALITY ASSURANCE

- A. Turf Manufacturer Qualifications
 1. Shall be experienced in the installation of synthetic infill grass (including in-house factory extruded RootZone® fiber) for a minimum of five (5) years.
 2. Shall have a minimum of 500 full sized tall fiber infilled type field installations. Field size to be a minimum of 65,000 square feet to qualify.
 3. Manufacturer must have completed a minimum of (20) prefabricated fields. Pre-fabrication refers to factory installed in the playing field the; center hashmarks, numbers, arrows. Endzone letter. Those items must be factory installed, no field installation ALLOWED of those items to meet this qualification.
 4. Shall provide third party certification confirming compliance with referenced standards.
 5. Turf Manufacture must formulate and produce its own fiber masterbatch.
 6. No third party manufacturing allowed. Extrusion, tufting and coating must be completed within the same building. No transportation of Grey good materials allowed.
- B. Installer Qualifications:
 1. Installation team shall be an established, insured installation firm experienced as a premium turf installer with suitable equipment and supervisory personnel, with a minimum of five years' experience with 15 foot wide tufted materials.
 2. Installation team shall be trained and certified, in writing, by the turf manufacturer, as competent in the installation of the specified material, including seaming and proper installation of the infill mixture.
 3. Site superintendent shall have at least 35 installations that are of the ASTROTURF PRODUCT that utilizes nylon Rootzone.
 4. Installation Team/Company must provide W2 statements for last 24 months that they have been employed by either the bidding contractor or turf manufacture. No non-certified installers of AstroTurf can handle or install the product.

- C. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields. The materials as hereinafter specified, should be able to withstand full climatic exposure, be resistant to insect infestation, rot, fungus and mildew; to ultra-violet light and heat degradation, and shall have the basic characteristic of flow-through drainage allowing free movement of surface run-off through the turf and directly into prepared granular base and into the field drainage system.
The synthetic turf and components shall be of national reputation. The turf fabric shall be installed by factory-authorized and certified technicians.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit synthetic turf work to be performed according to Contractor or Turf Provider's written instructions and warranty requirements.
- B. Field Measurements: Indicate measurements on Shop Drawings.

1.6 WARRANTY – Special warranty for American Football: Turf must maintain an ASTM F 355 Gmax of less than 165 for the life of the warranty. This is for the entire warranty period of eight (8) years.

1.7 MAINTENANCE SERVICE – Turf Installation Contractor shall train maintenance staff and/or contracted maintenance staff in the use of the recommended maintenance equipment and provide maintenance guidelines to the facility maintenance staff.

PART 2 - PRODUCTS

2.1 PERMEABLE BASE ROCK AND FINE AGGREGATE LEVELING LAYER

- A. The permeable base rock layer at Drainage trenches shall conform to CalTrans Class 2 permeable aggregate per 68-2.02F.
- B. The permeable base fine aggregate leveling layer is a crushed rock fine aggregate with a particle size distribution as follows:

Mesh Size	% Passing
1/2"	100
3/8"	100
1/4"	95-100
#4	65-85
#8	40-65
#16	25-40
#30	15-30
#50	10-20
#100	0-6
#200	0-3

- C. See Section 321126 for typical aggregate base layer not at drainage trenches.

2.2 GEOTEXTILE LINER

- A. Geotextile liner is a minimum 6.0 oz./sq yd nonwoven polypropylene fabric with minimum average 160 lbs of tensile strength and minimum 110 gal/min/sq ft flow rate; Reed&Graham RG60N, Mirafi 160N, or approved equal.

2.3 COMPOSITE WOOD NAILER

- A. The perimeter composite wood nailer shall be a minimum 2x4 sized composite wood (Trex), structural HDPE lumber product, or approved equal.

2.4 SHOCK PAD

- A. A composite interlocking resilient panel specifically designed for use with synthetic turf applications and approved in writing by the synthetic turf manufacturer for warranty compliance, meeting the following:
 - 1. Resistant to bacteria or fungi growth per ASTM G22-76/G21-96
 - 2. Be either thermally stable, or have expansion joints integrated into the product and/or installation to accommodate thermal expansion and contraction over the full width and length of the playing surface.
 - 3. Shall have a Gmax rating less than 120 with the synthetic turf carpet system.
 - 4. Shall have a minimum manufacturer's warranty of 16 years.
- B. Acceptable product as a standard of quality is Brock SP-14 porous closed cell polypropylene panel, 14mm thick. Alternate provider is acceptable and must meet and/or be equivalent to all listed requirements, qualifications and specifications

2.5 ACCEPTABLE TURF MANUFACTURERS

- A. Pre-Approved turf manufacturer as a standard of quality
 - 1. AstroTurf Corporation
2680 Abutment Road, SE
Dalton, GA, 30721
Dominick Berarducci
P: 559-612-9065
 - 2. Alternate provider is acceptable and must meet and/or be equivalent to all listed requirements, qualifications and specifications.

2.6 TURF MATERIALS

- A. Synthetic Turf System: A complete synthetic turf system consisting of a combination of a 10,000 denier parallel slit film fibers along with Polyethylene/Nylon blend Monofilament 330 micron along with an in-house factory extruded monofilament RootZone®. Pile height shall be nominal 2.0". Fibers shall be tufted to a primary backing and a mechanically applied adhesive secondary backing.
 - 1. The tufted fiber's face weight shall not weigh less than 60 ounces per square yard. The tufted rows of fiber are to be spaced no more than 3/8" apart. ASTM tests proving the fiber meets these qualifications must be provided with the bid. Turf systems that do not meet this specification will be disqualified.
 - 2. The carpet's primary backing shall have a minimum weight of 8 oz per square yard. The carpet shall then be coated with a secondary backing of polyurethane synthetic coating material with a minimum application rate of 20 ounces per square yard, no third party coaters allowed and then perforated for adequate drainage. Carpets that are not perforated for adequate drainage shall not be acceptable.
 - 3. The carpet shall be delivered in 15' wide rolls. The rolls shall be of sufficient length to go from sideline to sideline. Head seams, other than at sidelines, will not be acceptable.
- B. The infilled pile surface shall provide good traction in all types of weather with the use of conventional sneaker type shoes, composition molded sole athletic shoes, and screw- in style football cleats.

- C. The pile surface shall be suitable for both temporary and permanent line markings using acrylic paint, as per the turf provider's recommendations.
- D. All adhesives used in bonding the seams shall be resistant to moisture, freeze/thaw, bacteria and fungus attacks, and resistant to ultraviolet radiation. The adhesive shall be made especially for the adhesion of synthetic turf seams and inlaid field markings and graphics.
- E. The seam specific adhesive system shall have been utilized on at least 25 full installations. Provide this information with the bid. It shall consist of a factory-made adhesive bed applied to a non-woven fabric seaming tape. The adhesive bed shall be a metered amount suitable for the application. It shall be heat and pressure activated. A special heat application machine and pressure application using weighted rollers is mandatory.
- F. Supply field groomer and sweeper or single maintenance apparatus that performs both basic maintenance functions.
- G. Perimeter edge details required for the system shall be as detailed and recommended by the turf provider, and as approved by the turf provider.

2.7 TURF FABRIC SURFACE

- A. The pile surface shall resemble freshly mown natural grass in appearance, texture and color.
- B. The pile surface shall be nominally uniform in length.
- C. The pile fiber angle shall be 90 degrees $\pm$ 15 degrees, measured from the horizontal after installation of the infill material.
- D. The entire system shall be resistant to weather, insects, rot, mildew and fungus growth and will be non-allergic and non-toxic.
- E. The synthetic turf system shall have a nominal fiber length of 2.0".
- F. Each roll shall be minimum 15' wide
- G. The entire system shall be constructed for porous standards as specified. Synthetic turf system shall be perforated at 4 – 6" on center. Systems that are not perforated for maximum drainage shall not be acceptable.
- H. All markings shall be tufted in-place, inlaid or glued. It is recommended that the maximum amount of markings be factory-prefabricated into the turf system prior to shipment to site. At a minimum all football markings (with the exception of hash marks) shall be factory prefabricated.

2.8 PRODUCT SPECIFICATIONS – TURF

- A. Face Yarns shall be a combination of:
 - 1. A proven athletic quality, outdoor stabilized parallel slit film polyethylene fibers and TRIONIC Polyethylene/Nylon blend Monofilament blended together;
 - 2. An in-house factory extruded texturized monofilament RootZone designed specifically for outdoor use, to best resist the effects of ultraviolet degradation, heat, foot traffic, water and airborne pollutants.

- B. The fabric shall possess the following minimum physical characteristics. ASTM testing shall be provided with the bid and any products not meeting the minimum physical characteristics will be rejected:

Average Pile Yarn Face Weight	ASTM D 5848	60 oz/square yard
Average Total Weight	ASTM D 5848	88 oz/square yard
Secondary Backing Weight	ASTM D 5848	20 oz/square yard
Primary Backing	ASTM D 5848	8 oz/square yard
Average Tuft Length	ASTM D 5823	2.00"
Tufting Gauge	ASTM D 5793	3/8" maximum
Tuft Bind	ASTM D 1335	> 8 lbs
Yarn Denier (slit film fiber)	ASTM D 1577	10,000/1
Yarn Denier (Trionic Monofilament)	ASTM D1557	1800/6
Yarn Denier (thatch rootzone)	ASTM D 1577	5,400/8
Fiber Thickness (primary/secondary)	ASTM D 3218	100 microns slit
Surface Flammability	ASTM D 2859	8 of 8 PASS
Permeability	ASTM F 1551	>30
Melt Point	ASTM D 789	248 degrees Fahrenheit
Gmax System (American Football)	ASTM F 355	<125 at installation
		< 165 over life of Warranty

2.9 INFILL MATERIAL

- A. The infill shall be an engineered system of a fine organic material surface layer with a silica sand base layer. Crumb rubber or EPDM infill material is not allowed.
- B. Acceptable infill products are 'BrockFill' engineered wood fiber, Greenplay 'Natural Cool' coco-fill, or approved equal.
- C. Silica sand infill:
- Must be clean, sub-angular silica sand
 - Must be a 20-40 sieve size.
- D. Immediately after infill layers are installed, infill depth must be measured per testing protocol detailed in Section 1.3 C. 2 above to ensure that infill layer is at least 1.46" deep.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of the synthetic turf, examine substrates and conditions, with Installer present, for compliance with requirements for visual installation tolerances. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Certification of prior work: The synthetic turf manufacturer and / or certified installation contractor shall perform a visual inspection of the field base onto which the synthetic turf system is to be installed and to examine the finished surface for required compaction, and grade tolerances (through string line testing). After any discrepancies between the required materials, application and tolerance requirements noted have been corrected, the synthetic turf installer should submit a written certification of VISUAL acceptance of the base for installation of the synthetic turf system. Any tests other than VISUAL tests (string line, water hose, etc...) shall be the responsibility of the General Contractor, Architect, Engineer, or Sports Field Consultant.

- C. Installation of all materials shall be performed in full compliance with approved project shop drawings. Only factory trained and certified technicians skilled in the installation of athletic caliber synthetic turf systems, working under the direct supervision of the turf manufacturer's project managers, shall undertake the placement of the turf system. The designated supervisory personnel on the project must be certified, in writing by the turf provider as competent in the installation of these materials, including proper seaming and proper installation of the infill mixture. The turf provider shall certify the installation and warranty compliance.

3.2 PREPARATION

- A. Inspect delivered field surface fabric and components immediately prior to installation. Any damaged or defective items shall be rejected. Installed synthetic turf system shall be inspected for, but not limited to, the following:
 - 1. Uniformity of product and color
 - 2. Surface wrinkles
 - 3. Field markings
 - 4. Filed Edge installation
 - 5. Pile height of each roll shall be measured. Any material(s) that does not meet minimum height and thickness specifications shall be rejected. Pile height shall be measured in its finished positions.
- B. Environmental Conditions: Weather conditions are important for the successful installation of the systems. No work under this section will proceed when:
 - 1. Ambient temperatures are below 45 degrees F.
 - 2. Material temperatures are below 45 degrees F.
 - 3. Surfaces are wet or damp
 - 4. Rain is imminent or falling.
 - 5. Conditions exist or are imminent, which will be unsuitable to installation requirements of the systems specified herein. Humidity levels will be inside the limits recommended by the adhesive manufacturer to obtain optimal bonding characteristics of the surfaces.

3.3 INSTALLATION OF THE SYNTHETIC TURF

- A. The full width rolls shall be laid out across the field. When all of the rolls of the playing surface have been installed, the sideline areas will be installed at right angles to the playing field turf. All seam widths are to be held to a minimum and shall be traverse to the field direction. Seams shall be flat, tight, and permanent with no separation or fraying. All seams shall remain as required for the duration of the warranty period.
- B. The perimeter of the field shall be firmly secured to the edge anchors for the life of the warranty and in accordance to project details.
- C. Resilient Infill
 - 1. The sand ballast infill material shall be spot inspected and tested for conformance to sieve specifications.
 - 2. Sand ballast Infill must be placed in such a way as to minimize fiber entrapment.
 - 3. The infill layers must be uniformly applied so as to ensure uniform, predictable surface.
 - 4. After infill layers are installed, infill depth must be measured to ensure that infill depth is at least 1.46" deep.

3.4 FIELD LINING AND MARKINGS

- A. All markings shall be installed in accordance with prior approved project Shop Drawings.

- B. All center hashmarks, numbers, arrows and endzone letter must be factory installed in the main body field panels. No field installation for these items is to be allowed. Shop drawings must indicate these items as factory installed and any material onsite that does not have these items installed at factory are not acceptable.
- C. Inlays shall conform to the turf manufacturer's specifications, directions and recommendations for the best results.
- D. Striping layouts shall be accurately measured by the Contractor before installation of inlaid field markings
- E. Install inlays only when the surface is completely dry. Adhere all inlays securely into place. Never loose-lay and sew an inlay into place.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of completed applications of synthetic turf system shall take place in suggestive states, in areas of extent and using methods that are industry standard. Do not proceed with application of next stages until test results for previously completed applications show compliance.
- C. Remove and replace items where test results indicate that it does not comply with specified requirements.
- D. HIC Testing shall be completed at the final installation in 10 locations. Fall height shall be a minimum of 1.3 meters and no location shall exceed 1,000 HIC. All test reports are to be supplied to the Owner, Architect and turf manufacture.

3.6 FINAL ACCEPTANCE

- A. Upon final acceptance, the Manufacturer shall submit to the Owner three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and striping.
- B. The Manufacturer shall ensure that the turf can be plowed with Manufacturer approved snow removal equipment as detailed in the provided Maintenance Manuals.
- C. The finished playing surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use.

3.7 CLEANING

- A. Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items. All usable remnants of new material shall become the property of the Owner. The Contractor shall keep the area clean throughout the project and clear of debris. Surfaces, recesses, enclosures, etc. shall be cleaned, as necessary, to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

3.8 GROOMING MACHINE

- A. The contractor shall provide the Owner with the following synthetic turf grooming equipment to maintain the synthetic turf. The synthetic turf supplier/installer shall provide one training session with the Owner's maintenance personnel on the equipment's maintenance procedures and recommended operation.
1. TurfCare TCA 1400. Available from SMG Equipment, 253-350-8803

END OF SECTION 32 11 26

SECTION 32 12 16
SOIL STERILIZATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work specified in this section.

1.2 SECTION INCLUDES

- A. Furnish and install soil sterilant under all asphalt paving.

1.3 RELATED SECTIONS

- A. Section 312000 – Earthwork: Excavation, Filling, and Grading
- B. Section 312333 – Trench Excavation and Backfill
- C. Section 321126 – Aggregate Base Course
- D. Section 321217 – Asphalt Paving
- E. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.

1.4 STANDARDS

- A. In accordance with the following:
 - CCR-T21 California Code of Regulations, Title 21 Public Works.
 - CBC California Building Code, California Code of Regulations, Title 24, Part 2, CCR-T24.
 - USDA United States Department of Agriculture.
 - EPA Environmental Protection Agency.
 - CM City of Madera
 - All applicable Environmental Regulations and Standards.

1.5 QUALITY ASSURANCE

- A. Provide licensed operator to apply soil sterilant.
- B. All products shall comply with the current EPA laws at time of application. Should the products listed become unavailable because of changes in the law, submit substitute products for review by the Owner.

1.6 SUBMITTALS

- A. Submit in accordance with Specification Section SUBMITTAL PROCEDURES.
- B. Certificates of application.
- C. Certificates of compliance for material.

1.7 COORDINATION

- A. Coordinate with other work, including subgrade preparation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Soil Sterilant: Bayer Oust XP, weed and grass preventer, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that site is ready for application.

3.2 PREPARATION

- A. Identify installation locations.
- B. Employ equipment and methods appropriate to the work site.

3.3 APPLICATION

- A. Thoroughly water soak surface to be treated. Avoid excessive water runoff.
- B. Apply sterilant solution over surface to receive pavement or surfacing prior to the start of pavement or surfacing installation.
- C. Apply in spray form, at rate as allowable by State of California and the manufacturer's recommended application rate.
- D. Take all precautions to limit soil sterilant solution to areas immediately under proposed pavement or surfacing. Use shields as necessary, and do not apply under windy conditions.

3.4 FIELD QUALITY CONTROL

- A. Field inspection will be performed under Specification Section QUALITY REQUIREMENTS.

END OF SECTION 32 12 16

SECTION 32 12 17 ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Provide all material, labor, equipment and services necessary to completely install all pavement materials, accessories and other related items as required by the Contract Documents.

1.3 RELATED SECTIONS:

- A. All Division 00 Specification Sections
- B. All Division 01 Specification Sections
- C. Section 312200 - Earthwork: Excavation, Filling, and Grading
- D. Section 312333 - Trench Excavation and Backfill
- E. Section 321126 - Aggregate Base Course
- F. Section 321216 - Soil Sterilization

1.4 REFERENCES

- A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with SSCDOT.
- B. Mixing Plant: Conform to SSCDOT.
- C. Installation Criteria: Asphalt concrete shall show no evidence of cracking, uneven settlement, improper drainage, or untoward junctions with adjoining or existing surfaces. Work displaying such conditions shall be corrected under the Contractor's guarantee of all work.

1.6 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Mix design
- C. Certificates of compliance for material.
- D. Load tags for delivered material.

1.7 COORDINATION

- A. Coordinate with other work, including subgrade preparation, aggregate base placement and soil sterilization.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt-concrete when atmosphere temperature is less than 50 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Paint Binder: In accordance with SSCDOT Section 94, Asphaltic Emulsions.
- B. Asphalt-Concrete: Type A in accordance with Section 39, SSCDOT, ½ inch or ¾ inch maximum aggregate (medium) as indicated on the Plans. The asphaltic concrete shall be compacted to an average relative compaction of 97 percent, with no single test value being below a relative compaction of 95 percent based on a 50 blow Marshall maximum density. Use asphalt binder performance grade PG 64-10.
- C. Seal Coat: Asphalt based seal coat shall be "Ace Seal" as manufactured by Asphalt Coatings Engineering, Wasco, California, or approved equivalent

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify quantities required. New asphalt-concrete paving is required at all locations shown on the plans, and where existing asphalt-concrete paving to remain is removed or damaged by the Project excavation or related work.
- B. Verify that subgrade or base material has been compacted to required relative compaction and is dry.
- C. Verify gradients and elevations of base are correct.
- D. Verify that subgrade or base material has been sterilized per Section 32 12 16 SOIL STERILIZATION.

3.2 AGGREGATE BASE

- A. Where shown on the construction plans, place and compact aggregate base course per Section 321126 AGGREGATE BASE COURSE.
- B. Where shown on the construction plans, place asphalt on compacted earth subgrade per Section 312000 EARTHWORK: EXCAVATION, FILLING AND GRADING and Section 312300 TRENCH EXCAVATION AND BACKFILL.
- C. A soil sterilant shall be applied over the entire area which is to be paved in accordance with Section 311216 SOIL STERILIZATION

3.3 PREPARATION – PAINT BINDER

- A. Apply paint binder to existing asphalt-concrete or concrete surfaces which will be in contact with asphalt-concrete surfacing.
- B. Rate of application for all surfaces against which asphalt concrete is to be placed shall be no less than 0.02 and no more than 0.05 gallons per square yard. All vertical concrete surfaces

which will be in contact with asphalt concrete surfacing and all areas now in place which will be covered with new surfacing materials and feathering operations shall be coated with a paint binder applied at the rate of 0.05 gallons per square yard.

3.4 INSTALLATION OF ASPHALTIC-CONCRETE

- A. Install in conformance with SSCDOT Section 39, Asphalt-Concrete.
- B. Thickness - As shown on construction plans. Where thickness exceeds 3 inches, place in no less than 2 layers with top layer no thicker than one inch. Asphaltic concrete shall be laid to the thickness designated on the Plans. The plan thickness is to be considered as a minimum thickness. The Contractor shall lay the asphaltic concrete to a depth required to insure that, after compaction, the in place compacted thickness is equal to or greater than the specified plan thickness.
- C. The Contractor shall provide to the Engineer the truck delivery weight tags for the asphaltic concrete material. The quantity delivered shall be equal to or greater than the calculated in place quantity based on the specified thickness and area to be paved as designated on the construction plans and based on a unit density of the asphaltic concrete of 141 pounds per cubic feet.
- D. Asphalt binder: PG 64-10
- E. Compaction Equipment - In accordance with Section 39, SSCDOT. At small difficult areas, equipment may be altered as approved by Engineer.
- F. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities and to be true to grade and cross-section.

3.5 TOLERANCES –GENERAL

- A. Finished Surface: within 0.02 foot of planned grade.
- B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.
- C. Scheduled Compacted Thickness: Not less than specified.

3.6 INSTALLATION OF SEAL COAT

- A. Immediately prior to applying the sealer, the surface shall be cleaned of all loose material which might adversely affect bonding of the sealer. Any standard cleaning method such as power sweepers and blowers may be employed. In areas where gasoline, grease, oil spots, or chemical stains have been in contact with pavement, "Poly Oil Sil" or approved equal emulsion primer shall be applied to the pavement surface per manufacturer recommendations prior to placing seal coat. In locations where the pavement has been softened by contact with oils, fuels, or other substances, remove and replace pavement as directed by the Engineer.
- B. Where cracks in pre-existing pavement exceed 1/2 inch in depth or 1/4 inch in width, or both, shall be thoroughly cleaned and repaired with Type A, No. 4 maximum asphalt concrete before placing the sealer. All cracks between 1/8" and 1/4" in width shall be filled with "Flex Crax", as manufactured by Asphalt Coatings Engineering, of Wasco CA, or approved equivalent, in accordance with the manufacturer's recommendations.
- C. Whether or not specifically indicated on the plans, all loose or raveling pavement, potholes and badly distorted or depressed areas, except those lying within areas designated for pavement removal and replacement, shall be properly cleaned and repaired by applying a binder coat and

Type A, 3/8-inch maximum asphalt concrete patch conforming to the requirements of Section 39, SSCDOT, before placing the seal coat. Any vegetation such as, a soil sterilant per Section 32 12 16 SOIL STERILIZATION shall be applied to the area and any required pavement patching shall then be completed.

- D. Except as otherwise indicated on the Plans, asphalt-based seal coat shall not be applied to new asphalt concrete pavement. Unless otherwise authorized by the Engineer, asphalt-based seal coat shall not be applied to new asphalt concrete pavement until a minimum of twenty-one (21) calendar days have elapsed since pavement placement.
- E. The new seal coat shall fully cover the appearance of old pavement marking and striping. Otherwise, additional coats of seal coat shall be applied to the surface until the old pavement marking and striping is no longer visible.
- F. Two coats of asphalt-based seal coat shall be applied. The first coat shall have added to it a silica sand mineral filler which has passed a 50-mesh screen. Apply at a rate of 2 to 3 pounds per 1 gallon of concentrated sealer. When the first coat is dry enough to walk on without picking the material up, a second coat shall be applied without mineral filler. If the manufacturer indicates that the product may be diluted, it may be diluted with no more than 20 percent by volume clean fresh water with the prior approval of the Engineer. The total application rate shall be as follows:
 - 1. Seal Coat (for existing pavement) - 35 to 40 gallons of undiluted product per 1,000 square feet, as directed by the Engineer.
- G. Protect sealed surface until it is cured.

3.7 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. Pavement shall comply with the following:
 - 1. Water shall not be able to accumulate at any point and the surface shall be free to drain to drainage inlets or gutters.
 - 2. The paving contractor shall water flood the surface with the use of a water truck. If, after 30 minutes on a 70 degree F day, "bird baths" are evident in a depth more than 0.01 foot, the paving contractor and the Owner's representative will determine the best method of correction.
 - 3. A 10 foot straightedge shall be used to check for high spots and ridges. High spots and ridges out of compliance shall be reduced by a remedy determined by the paving contractor and the Owner's representative.
- C. Should a section of the work be not acceptable on the basis of inadequate compaction and/or the mixture becomes loose and broken, mixed with dirt, out of tolerance, or in any other way defective, it shall be repaired or removed and replaced with fresh mixture and immediately compacted to conform to the surrounding area to the satisfaction of the Owner.

3.8 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury.
- B. Protect sealed surface until it is cured.

END OF SECTION 32 12 17

**SECTION 32 13 13
SITE CONCRETE IMPROVEMENTS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY:

- A. This Section includes the following:
 - 1. All material, labor, equipment and services necessary to completely install exterior Portland cement flatwork, cast-in-place concrete, and architectural flatwork concrete, accessories and other related items, slabs, ramps and sidewalks and walkways, curb and gutter, mowstrips, and other miscellaneous concrete items of the form and dimensions shown on the plans and necessary to complete the project, and in accordance with the requirements of the Standard Specifications as modified and supplemented by these Special Provisions
 - 2. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.
- B. RELATED SECTIONS:
 - 1. Section 312000 - Earthwork: Excavation, Filling, and Grading
 - 2. Section 321126 - Aggregate Base Course
 - 3. Section 321315 - Concrete Reinforcement

1.3 REFERENCES

- A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.
- B. ACI standards, including but not limited to #304, 305, 306, 308, 309 and 347.
- C. ASTM standards, including but not limited to #C-33, C-39, C-94, C-136, C-143, C-150, and C-309.

1.4 SUBMITTALS

- A. Submit under provisions of Specification Section SUBMITTALS.
 - 1. Certificates of compliance for materials and mix designs.
 - 2. Load tags for delivered material.
 - 3. Strength testing as required by the approving agency.
 - 4. Integral color sample, where applicable.
 - 5. Application instructions for the architectural finish materials.
 - 6. Accessories and manufacturer's installation specifications.

1.5 QUALITY ASSURANCE

- A. Furnish concrete materials conforming with SSCDOT.
- B. Perform work in accordance with SSCDOT, unless noted otherwise herein.

PART 2 - PRODUCTS

2.1 MIXES

- A. Mix Design and Proportions in accordance with SSCDOT:
1. Mix designs with Fly Ash content no greater than 15 percent of the total weight of cementitious materials shall be proportioned by SSCDOT.
 2. Provide a maximum of 4 percent air entrainment, unless noted otherwise.
 3. Owners Testing laboratory shall review all mix designs before submittal.
 4. All concrete shall have the following minimum compressive strengths in accordance with ACI 318 and SSCDOT at 28 days and shall be proportioned within the following limits:
 - a. Site Concrete: Use for exterior concrete slabs on grade including, but not limited to sidewalks, curbs, gutters, mow strips, utility appurtenances and miscellaneous site improvements.
 - 1) Strength: 3,000 psi at 28 days
 - 2) Maximum Aggregate Size: 1-inch
 - 3) Cement Type: Type II
 - 4) Cement Content: 5.5 sacks/yd minimum
 - 5) Max Water/Cement Ratio: Per SSCDOT
 - 6) Admixture: Per SSCDOT
 - b. Structures & Vehicular Concrete Paving: Use for site structures and exterior slabs on grade subject to vehicle traffic.
 - 1) Strength: 4,000 psi at 28 days
 - 2) Maximum Aggregate Size: 1-inch
 - 3) Cement Type: Type II
 - 4) Cement Content: 6.5 sacks/yd minimum
 - 5) Max Water/Cement Ratio: Per SSCDOT
 - 6) Admixture: Per SSCDOT
 - c. Slurry Backfill: Use for backfill of over-excavated trenches, encasement of all penetration, and site utility piping.
 - 1) Maximum Aggregate Size: 3/8-inch
 - 2) Cement Type: Type II
 - 3) Cement Content: 2.0 sacks/yd minimum
- B. Reinforcement shall comply with relevant portions of Division 32 Specification Section CONCRETE REINFORCEMENT.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Subgrade shall conform to the requirements of Division 31 Specification Section EARTHWORK: EXCAVATION, FILLING AND GRADING. The District may elect to verify compacted subgrade elevations by measurement made from adjacent existing improvements or by a template supported by forms.

3.2 GENERAL CONCRETE

- A. Concrete placement shall conform to the applicable requirements of Standard Specification Sections 51 and 90. Concrete shall not be placed when the air temperature in the shade at the project site exceeds 95° F or is below 45° F, or when the temperature of the concrete exceeds 85° F.
- B. After the concrete has been placed, it shall be struck off to proper section and compacted with a grid of parallel metal bars until a layer of mortar not less than 3/8 inch thick has been brought to

the surface. All exposed concrete surfaces shall receive a medium broom finish applied transversely to the line of pedestrian traffic or to the longest dimension of the concrete, as applicable.

- C. General concrete surfaces shall be cured by the curing compound method and shall be protected in accordance with the provisions of Subsections 90-1 and 90-2 of the Standard Specifications.

3.3 PROTECTION OF CONCRETE

- A. The Contractor shall be responsible for the condition of all concrete work until such time as all work has been completed and is accepted by the District. The Contractor shall limit vehicular travel across concrete until such time as the concrete has achieved strength sufficient that it can support traffic without damage. In no case, however, will vehicles be allowed to travel across new concrete improvements until seven calendar days have passed since the concrete was placed.

3.4 CONCRETE JOINTS

- A. Expansion joints and weakened plane joints shall be constructed at the locations shown on the plans or as directed by the Engineer. Where joint locations are not specified on the plans, expansion joints shall be constructed at maximum intervals of 30 feet, and weakened plane joints shall be constructed at maximum intervals of 10 feet.
- B. Expansion joints shall be considered as weakened plane joints for the purpose of spacing weakened plane joints. Expansion joints shall be tooled with a 1/4 inch maximum radius edger, and shall be filled with 3/8 inch pre-formed expansion joint filler.

3.5 CONCRETE FINISHES

- A. Where concrete is being installed adjacent to or near existing concrete improvements, match the finish of similar concrete surfaces (i.e. new sidewalks shall match existing sidewalks, new curbs shall match existing curbs, etc.).
- B. Sidewalks and Mowstrips: Medium sweat finish or medium broom finish perpendicular to the direction of travel.
- C. Curbs: Trowel smooth and finish with a light brush.
- D. Gutters: Medium broom finish parallel with curb or direction of flow.
- E. Drive approaches and wheelchair ramps: medium broom finish, perpendicular to the direction of travel.

3.6 INSTALLATION OF ACCESSORIES

- A. Strictly comply with manufacturer's instructions and recommendations and approved details. Securely anchor work to substrate.

3.7 REPAIR AND CLEAN-UP

- A. Contractor shall legally remove all trash, debris, containers and excess materials from the site on a periodic basis, and shall keep the work broom clean until Owner's acceptance.
- B. The Contractor shall be held responsible for the repair and/or replacement of new or existing improvements damaged as a result of this work to the satisfaction of the Owner.

- C. The Contractor shall provide roll-off bins for wash-out of ready mix concrete trucks and pumpers. Do not allow concrete debris or cement water onto soils scheduled for landscape planting.

END OF SECTION 32 13 13

SECTION 32 13 15 CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY:

- A. This Section includes the following:
 - 1. Deformed reinforcing bars for site concrete improvements.
- B. RELATED SECTIONS
 - 1. Section 321313 - Site Concrete Improvements.

1.3 SUBMITTALS

- A. Submit in accordance with Specification Section SUBMITTALS and the Contract General Conditions.
 - 1. Mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered. If mill test reports are not available and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove yield strength and bending.
 - 2. Drawings and placing diagrams for each grade slab including dowels and corner bars.
 - 3. On the placing diagrams, show all openings for pipelines and architectural features. Include additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings.
 - 4. Coordinate placing diagrams with the concrete placing schedule.

1.4 PRODUCT DELIVERY

- A. Deliver reinforcement to project site in bundles marked with tags indicating bar size and length.
- B. Store on wooden supports above ground surface.

PART 2 - PRODUCTS

2.1 BARS

- A. Bars shall be deformed billet steel conforming to ASTM A 615, Grade 60. Mixing of steel grades will not be allowed.

2.2 BAR SUPPORTS

- A. Bar support shall be concrete or metal chairs, spacers or hangers. Reinforcing bars shall not be supported by forms.

2.3 TIE WIRE

- A. Tie wire shall be annealed steel wire of not less than 16-gauge.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Position reinforcement in accordance with the drawings, secure with wire ties or suitable clips at all intersections, and support by an adequate number of concrete or metal chairs, spacers, or metal hangers such that reinforcing bars do not sag more than one quarter of an inch (1/4") between supports. Do not place reinforcement or supports in contact with the forms. Bend tie wires away from the forms in order to provide the specified concrete coverage. To secure reinforcement in position, the Contractor may elect to locate bars additional to those shown on the drawings, but at no additional cost to the Owner.
- B. Set reinforcing dowels and anchor bolts in place prior to placing concrete. Do not press them into the concrete after the concrete has been placed.

3.2 SPLICES

- A. Splice bars only at locations shown on the drawings. Where splices are not detailed, lap bars 72 bar diameters.

3.3 CLEANING

- A. Remove dirt, form oil, excessive rust, cement coating from previous pours, and foreign matter that will reduce bond with concrete.

3.4 PROTECTION DURING CONCRETING

- A. Keep reinforcing steel in proper position during concrete placement.

END OF SECTION 32 13 15

**SECTION 32 15 40
CRUSHED STONE SURFACING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish and install decomposed granite surfacing which includes:
 - 1. Sub-grade Preparation
 - 2. Base Preparation
 - 3. Edge restraint
 - 4. Stabilizer
 - 5. Compaction
 - 6. Cleanup
- B. Related work:
 - 1. Section 312200 - Earthwork
 - 2. Section 312222 - Soil Materials
 - 3. Section 321216 - Soil Sterilization
 - 4. Section 321126 - Aggregate Base
- C. Definitions: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

1.2 SUBMITTALS:

- A. Procedure: Submittals shall be provided in accordance with Division 1 requirements.
- B. Submit aggregate sieve analysis, product specifications and a one pint representative sample of the proposed decomposed granite, with named source.

PART 2 - PRODUCTS

2.1 DECOMPOSED GRANITE

- A. Decomposed granite is referred to by the abbreviation (D.G.), or referred to as disintegrated granite. All decomposed granite for non-vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
3/8 inch	100
No. 4	90-100
No. 8	75-80
No. 16	55-65

Sieve Designation	% Passing
No. 30	40-50
No. 50	25-35
No. 100	15-20
No. 200	10-15

- B. All decomposed granite for vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
1/2 inch	95-100
3/8 inch	90-95
No. 4	65-80
No. 8	43-63
No. 16	40-49

Sieve Designation	% Passing
No. 30	30-40
No. 50	20-27
No. 100	10-18
No. 200	10-12

- C. The portion of D.G retained on the no. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96.
- D. The portion passing a No. 40 sieve shall have a maximum liquid limit of 25 and maximum plasticity index of 7 as determined by AASHTO T89 and AASHTO T90, respectively.
- E. The sand equivalent shall be in the range of 35-55. The R-value shall be a minimum of 71.
- F. Crushed aggregate screenings shall be free from clay lumps, vegetative matter and deleterious material.
- G. D.G. shall be grey in color.

2.2 SOIL BINDER

- A. Binder shall be a non-toxic, colorless, odorless, organic powder that binds D.G. screenings consisting of 95% Psyllium with a minimum 70% Mucilliod content. The binder shall be "Stabilizer" as manufactured by Stabilizer Solutions Inc., (800) 336-2468, FAX: (602) 225-5902, or equal.

2.3 EDGING

- A. Per details on plans.

PART 3 - EXECUTION

3.1 SUBGRADE AND DECOMPOSED GRANITE PREPARATION AND COMPACTION

- A. Subgrade under all D.G. shall be scarified to a minimum depth of 12", graded and compacted to 90% maximum dry density (relative compaction).
- B. Aggregate base under D.G. surfacing shall be in conformance with Section.
- C. After subgrade preparation or base installation, sterilize base or subgrade receiving D.G. surfacing per Specification Section SOIL STERILIZATION.
- D. Minimum compaction for pedestrian use D.G. surfaces shall be 85% maximum dry density (relative compaction), and 90% maximum dry density (relative compaction) for vehicular use. The Contractor shall provide one compaction test for every 2,000 square feet or fraction thereof.

- E. The finish grade shall be even between the headers with no humps or depressions greater than +/- 0.25" after the compaction.

3.2 SOIL STABILIZER AND DECOMPOSED GRANITE INSTALLATION

- A. Soil stabilizer shall be thoroughly mechanically blended per the manufacturer's recommendations with the D.G. screenings prior to transport to the job site.
 - 1. For vehicular and/or pedestrian use, the stabilizer shall be mixed at a minimum rate of 15 lbs. of Stabilizer product per ton of D.G. aggregate.
 - 2. For tree well use, the stabilizer shall be mixed at a minimum rate of 8 lbs. of Stabilizer product per ton of DG aggregate.
 - 3. Premixed Stabilizer and D.G. material can be obtained locally by contacting the stabilizer manufacturer and obtaining the location of a local vendor.
 - 4. Drop spreading of the Stabilizer product over raked D.G. screenings and mixing stabilizer by rototilling is NOT ACCEPTABLE.
- B. Place the premixed stabilizer product on the pre-soaked subgrade in maximum 2" lifts. Rake smooth to the desired grade and cross slope.
- C. After placement and raking, water the Stabilized D.G. to achieve full depth moisture penetration of the placed product. Apply 25 – 45 gallons per ton to achieve the proper full depth moisture penetration.
- D. After 6 – 72 hours for activation, roll the Stabilized D.G material with a 2 to 5 ton double drum roller to achieve finish grade and initial compaction without separation, plowing or any other physical compromise of the aggregate. Utilize a hand tamp at edges, around benches, and sign posts. Do not use a vibratory wacker plate or vibratory roller to compact the Stabilized D.G.
- E. Finish surface elevation:
 - 1. Compacted finish surface of DG shall be flush with headers, paving, mowstrips and/or curbs, unless otherwise indicated.
 - 2. Compacted finish surface of DG shall be two inches above finish grade in adjacent shrub/ground cover planting areas, unless otherwise indicated.
 - 3. Compacted finish surface of DG shall be one-half inch above finish grade in adjacent sodded turfgrass planting areas, unless otherwise indicated.
 - 4. Compacted finish surface of DG shall be flush to finish grade in adjacent seeded or sprigged turfgrass planting areas, unless otherwise indicated.
- F. Lightly spray the surface after compaction operations. Allow the finished surface sufficient time to dry prior to use.
- G. Finished surface shall be smooth, uniform and solid with no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material shall not be present on surface after installation, but may appear after use and according to environmental conditions. Pathway shall remain stable underneath loose granite on top with a "natural" look. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

3.3 CLEANUP

- A. After all stabilization operations are completed, remove trash, excess materials, empty containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.

- B. The D.G. surface shall be dragged and a final dressing performed within 48 hours prior to final acceptance.

END OF SECTION 32 15 40

**SECTION 32 17 23
PAVEMENT MARKINGS**

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Furnishing and installing paint parking stall, traffic marking and wording on asphalt concrete surfaces.
- B. Furnishing and installing disabled marking and hatching area on asphalt-concrete pavement.

1.2 RELATED SECTIONS:

- A. Section 32 12 17 – Asphalt Paving
- B. Section 32 13 13 – Site Concrete Improvements
- C. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.

1.3 REFERENCES

- A. SSCDOT Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment and to furnishing of materials by State.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Certificates of compliance for materials.

1.5 COORDINATION

- A. Coordinate work with other work, including associated traffic signing.
- B. Commence striping or marking of asphalt concrete no sooner than 7 days following any sealing of the asphalt concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Paint: Quick drying, high visibility water soluble acrylic striping paint; Stripe Master, Wikel Mfg. Company, or similar by Sherwin Williams, J.E. Bauer, or PPG, or approved equal.
- B. Paint shall be of color indicated on the construction plans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that site is ready for application.

3.2 PREPARATION

- A. Identify installation locations. Place parking stall striping, traffic marking, wording, disabled symbol and access striping at locations, as shown on construction plans.
- B. Thoroughly clean all surfaces to be painted.
- C. Employ equipment and methods appropriate to the work site.
- D. Provide vehicular and traffic controls per Division 1.

3.3 INSTALLATION

- A. Apply paint striping and marking as indicated on the plans.
- B. Apply paint uniformly, straight and true, with equipment designed for traffic striping and marking applications.
- C. Apply paint striping and marking per Section 84 of SSCDOT, except supply paint conforming to 2.1 A. of this specification.
- D. Apply a minimum of 2 separate coats of paint at all striping and marking locations, including asphalt concrete and concrete surfaces.
- E. Paint international symbol of accessibility at the location as shown on the plans.
- F. Paint accessible access area striping at the location as shown on the plans.

3.4 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Division 1.

END OF SECTION 32 17 23

**SECTION 32 31 13
CHAIN LINK FENCING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Provisions of constructing chain link fence at locations shown on the Construction Documents, including but not limited to:
 - a. Site chain link fencing and gates.
- B. RELATED SECTIONS
 - 1. Contract General Conditions and Division 1 Specifications.
 - 2. Section 31 20 00 – Earthwork: Excavation, Filling, and Grading
 - 3. Section 32 13 13 – Site Concrete Improvements

1.2 QUALITY ASSURANCE

- A. Qualifications of Installer
 - 1. Throughout the progress of installation of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.
 - 2. In actual installation of the work of this Section, use adequate numbers of skilled workmen to insure installation in strict accordance with the contract documents.
 - 3. In acceptance or rejection of work performed under this Section, the Engineer will make no allowance for lack of skill on the part of the workmen.

1.3 PRODUCT HANDLING

- A. Protection
 - 1. Use all means necessary to protect the materials of this Section before, during and after installation, and to protect the work of other trades.
- B. Replacements
 - 1. In the event of damage, immediately make all repairs and replacements necessary to the satisfaction of the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The materials and fabrication of chain link fabric shall conform to these specifications, and as shown on the plans and details.
- B. All ferrous materials shall be new and galvanized. Imperfectly galvanized material or material upon which serious abrasions of the galvanizing occur shall not be used.
- C. Height - all fencing shall stand at the heights shown on the plans.
- D. Fabric
 - 1. Standard: Chain link fabric shall conform to ASTM, designation: A392, Class 1. The wire used in the manufacture of the fabric shall be 9-gauge. All chain link fabric shall be

woven into approximately 2-inch mesh. Fabric shall be furnished with knuckling at all selvages. The knuckled selvage shall be used along all corners and edges. Fabric shall be GBW, galvanized before weaving.

- E. Posts, braces and gate frames
 - 1. The base material for the manufacture of steel pipe used for posts and braces shall conform to the specifications of ASTM, designation: A53 Type A, standard weight, Schedule 40, and the base material for the manufacture of other steel sections used for posts and braces shall be good commercial quality weldable steel.
 - 2. All posts, braces and gate frames shall conform to the size and weight designations shown on the plans.
 - 3. All posts shall be fitted with rainproof caps designed so as to fit securely over the top of the posts.
 - 4. All posts shall be of a total length of not less than the depth of the concrete footing as shown on the plans, plus the length required above ground.
 - 5. Posts and braces shall be galvanized in accordance with specifications of ASTM, designation: A123.
 - 6. All horizontal braces shall be attached to posts by approved steel fixtures.
- F. Stretcher bars and other required fittings and hardware shall be steel and shall be galvanized in accordance with the specifications of ASTM, designation: A153.
- G. All swinging gates and walk gates shall be installed with a gate holdback, Trimco 1209HOHA-626. Holdbacks shall be installed in the concrete mowstrip, unless otherwise noted.
- H. Concrete mowstrip shall be in accordance with Section 321313 SITE CONCRETE IMPROVEMENTS.
- I. Walk gates shall be constructed as per detail drawing and in accordance with CBC sections 11B-206.5 and 11B-404.
- J. Drive gate, roll gate and walk gate shall be constructed as per detail drawing.
- K. Non-accessible swinging gates shall comply with the following:
 - 1. Have a lockable fork latch.
 - 2. Have heavy-duty malleable iron hinges

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All posts shall be set in concrete footings as shown on the plans to within 3 inches of bottom.
- B. All vertical line and end posts shall be braced to the nearest adjacent vertical post with galvanized horizontal braces as shown on the plans.
- C. Welding
 - 1. All welding shall conform to the requirements of the California Building Code, CBC, Chapter 22.
 - 2. Where the galvanized surface has been burned by welding, all surfaces of the welded connections shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked galvanizing removed. The damaged area and weld shall then be painted in accordance with the following details.

- a. All galvanized, welded, or damaged surfaces that are to be painted shall first be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.
 - b. After washing, all areas shall be roughened by abrasive blasting using an abrasive that is no larger than 30-mesh. Galvanizing shall not be removed by this operation.
 - c. After preparation, all galvanized surfaces that are to be painted shall be covered with one application of zinc dust-zinc oxide primer, federal specification TT-P-641, Type II. The zinc dust-zinc oxide paint shall be applied by spraying to produce a complete covering of the galvanized surface.
 - d. After the application of the zinc dust-zinc oxide paint, one application of pre-treatment, vinyl wash primer, Section 91-2.7 of the state Standard Specifications, shall be applied to such surfaces. The vinyl wash primer shall be applied by spraying to produce a uniform wet film on the surface.
 - e. Such surfaces shall then be covered with two separate applications of white tint base vinyl finish coat, Section 91-2.22 of the state standard specifications, sufficient to completely cover the preceding color. Paint for the first application shall be tinted with a compatible coloring agent to slightly contrast with the color of the second application. After drying for 24 hours, one application of aluminum paint, finish coat, Section 91-2.8 of the state standard specifications, shall be painted on the welded areas.
- D. Perimeter fencing chain link fabric shall be fastened to the outside of the fence.
- E. All fabric shall be stretched and securely fastened to the posts, as follows:
- F. The fabric shall be fastened to end, corner and gate posts with 3/16 inch by 5/8 inch stretcher bars and not less than 1/8 inch by 3/4 inch stretcher bar bands spaced at one foot intervals for whatever widths of fabric are supplied. The fabric shall be fastened to line posts with tie wires or post clips. Tie wires shall be at least 9-gauge (0.148 inch diameter) steel. Post clips shall be at least 6-gauge (0.192 inch diameter) steel. The wire or clip fasteners shall be spaced at approximately 14 inches on line posts, with a minimum of 5 fasteners per 6 foot high post. Top and bottom edges of the fabric shall be secured to each horizontal brace with tie wires or fastened to tension wire with hog rings spaced at 15 inch maximum intervals. Hog rings shall be at least 9-gauge (0.148 inch diameter) steel. Wire ties shall be given at least one complete turn. Hog rings shall be closed with ends overlapping. The distance from the selvage to the braces or top rails shall be 2 inch maximum and shall be fastened to the brace or rail by wire fasteners spaced at approximately 14 inches with a minimum of 8 fasteners per each 10 foot horizontal span.
- G. Construct concrete mowstrip at the width as shown on the plans.

END OF SECTION 32 31 13

SECTION 32 31 19
DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY:

- A. This Section includes the following:
 - 1. Decorative metal fences and gates (shop fabricated)
- B. Related Requirements:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete setting fence posts.
 - 2. Division 05 Section "Metal Fabrications" for metal fabrications not included in this section.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Include plans, elevations, component details, and attachments to other work. Indicate materials and profiles of each metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative metal fencing and gates similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Installer Qualifications: Fabricator of products.
- C. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code – Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code – Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store decorative metal fencing and gates in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal fencing and gates by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements for Gates and Hardware: Pedestrian gates and hardware indicated to be accessible shall comply with accessibility requirements of the 2010 ADA Standards for Accessible Design and the 2019 California Building Code, Chapters 10 and 11B.
 - 1. Gates shall be capable of opening a minimum of 90 degrees.
 - 2. Gates in the open position shall provide a clear opening width of not less than 32 inches.
 - 3. The bottom 10 inches of the push side gates shall have a smooth uninterrupted surface that allows the door to be opened by a wheel chair footrest without creating a trap or hazardous condition.
 - 4. The effort to open gate shall not exceed a 5 pound force applied perpendicular to the face of the gate.
 - 5. Gates shall be openable from the secure side (inside) without the use of a key or special knowledge or effort. Operating hardware shall not require pinching or grasping to operate hardware.
 - a. Gates may be designed for key operation from either or both sides when the gates are not required egress gates as determined by the Architect and the Division of the State Architect.

2.2 STEEL AND IRON MATERIALS

- A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Tubing: ASTM A 500/A 500M (cold formed).
- C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M unless otherwise indicated.
- F. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel or structural steel, exposed.

2.3 FASTENERS

- A. Fastener Materials: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating or Type 304 stainless steel.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

- C. Post-Installed Anchors: Mechanical fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
 - 1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.5 SETTING MATERIALS

- A. Cementitious Material: Portland cement, ASTM C 150, Type II, gray.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information. Proportion normal-weight concrete mixture as indicated below for strength, slump, water/cement ration, and maximum aggregate size.
 - 1. Strength: 3000psi at 28 days.
 - 2. Aggregate Size: 1-1/2 inch maximum.
 - 3. Slump: 4 inches.
 - 4. Water Cement Ration: 0.53 Maximum.

2.6 FABRICATION. GENERAL

- A. Fabricate fence panels in sections to prevent the need for field welding or cutting. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
 - 1. Components of fabricated items shall not be finished until after fabrication.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- D. Provide necessary brackets to assemble units and to attach other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
- E. Connect members with full-penetrations welds unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

2.7 DECORATIVE METAL FENCING

- A. General: Fabricate decorative metal fencing from steel bars and shaped of sizes and profiles indicated.
 - 1. Fabricate fence panels in sections to facilitate galvanizing, transportations to the Project Site, and installation.
- B. Fence Height: As indicated on Drawings.
- C. Posts, Rails, and Pickets: Square steel tube sections complying with ASTM A-500 with hot dipped galvanized exterior zinc coating and as follows:
 - 1. Posts: Posts having a minimum yield strength of 45,000 psi and a minimum size as follows:
 - a. Posts for Fences: 4 inches square x 1/8 inch thickness.
 - 1) Spacing: Nominal 8 feet on center maximum; posts shall be equally spaced on a standard module.
 - b. Posts for Swing Gates: Size as follows:
 - 1) Gates to 48 inches Wide: 4 inches square x 1/8 inch wall thickness.
 - 2) Gates over 48 inches Wide to 96 inches Wide: 6 inches square x 1/4 inch thickness.
 - 3) Gates over 96 inches wide to 144 inches Wide: 6 inches square x 3/8 inch thickness.
 - 2. Horizontal Rails: 2 inches square x 11 gage (0.120 inch).
 - 3. Pickets: 1 inch square x 14 gage (0.080 inch).
 - a. Spacing: Nominal 6 inches on center nominal.
- D. Finish: Galvanize and powder coat after fabrication.

2.8 SWING GATES

- A. General: Fabricate decorative metal swings from steel bars and shapes of sizes and profiles indicated in Drawings, match characteristics of fence design.
- B. Gate Height: Match adjacent fence panels.
- C. Gate Width: As indicated on Drawings; 32 inches minimum clear width when gate is in a 90 degree open position.
- D. Gate Framing: Hollow tubular steel sections of size, wall thickness, and spacing as indicated on Drawings, not less than 2 inches x 2 inches x 11 gauge (0.120) minimum size).
- E. Rails: Match fence rails.
- F. Pickets: Match fence pickets.
- G. Hinges: Butt hinges or pivots as selected by fabricator; hinges to be sized for not less than twice the weights of the gate and allow the gate to open 180 degrees.
- H. Operating Hardware: Gates shall be prepared to receive a cylinder lock, mortise lock, or exit device as indicated on the drawings.
- I. Finish: Galvanize and powder coat after fabrication

2.9 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plate, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M. Galvanize items after fabrication.
 - 1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
 - 2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filling of smooth.
- B. Powder-Coat Finish for Galvanized Metal: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
 - 1. Prepare galvanized metal be thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 - 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 - 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 2 mils.
 - 4. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal fences and gates
- B. Proceed with installations only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Provide anchorage devices and fasteners where needed to secure decorative metal fencing to in-place construction.
- B. Set posts accurately in location alignment, and elevation; measured from established lines and levels.
 - 1. Post Excavation: Drill or hand-excavate holed for posts to diameters and spacings indicated, in firm, undisturbed soil. Footings shall have a diameter not less than 4 times the width of posts and shall extend 6 inches below the bottoms of the post.
 - 2. Post Setting: Set posts in concrete into firm, undisturbed soil. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices. Crown top of exposed concrete to drain water away from posts. Protect aboveground portion of posts from concrete splatter.
- C. Install gate level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary.
- D. Perform cutting, drilling, and fitting required to install decorative metal fencing. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

- E. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- F. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations by complete refinishing, or provide new units as required.
- G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication. General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 ADJUSTING

- A. Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortions, nonalignment, misplacement, disruptions, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.4 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint exposed areas with same materials as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/ A 780M.
- D. Protect finishes from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- E. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 32 31 19

SECTION 32 84 00 IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide all materials, labor, equipment and services necessary to furnish, install and maintain the Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Work Specified Elsewhere
 - 1. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to work of this section.
 - 2. Section 312000 – Earthwork
 - 3. Section 312300 – Trench Excavation and Backfilling
 - 4. Section 329000 – Landscape Planting
 - 5. Division 260000 – General Electrical

1.2 CODES AND REGULATIONS

- A. All work and materials shall be in full accordance with the following codes adopted and amended by the authority having jurisdiction. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. The work described in these specifications shall govern in the event that the drawings or specifications call for material or methods of construction of higher quality or standard than required by these codes.
 - 1. California Plumbing Code
 - 2. California Administrative Codes:
 - a. Title 8, Industrial Relations
 - b. Title 19, Public Safety
 - 3. California Electrical Code
 - 4. California Green Building Standards Code, Section 5.304.
 - 5. California Department of Water Resources, Model Water Efficient Landscape Ordinance (MWELO)
 - 6. Standards and Regulations of other agencies, water utility provider, or organizations as listed in this specification relating to products or procedures, e.g. American Society for Testing and Materials.

1.3 DEFINITIONS

- A. Piping: All pipe fittings, valves, and accessories as required for a complete piping system.
- B. PVC: Polyvinyl Chloride.
- C. Agencies and Organizations:
 - 1. ASTM- American Society for Testing and Materials
 - 2. AWWA- American Water Works Association
 - 3. IAPMO- International Association of Plumbing and Mechanical Officials
 - 4. CEC - California Electrical Code.
 - 5. UL - Underwriter's Laboratories
 - 6. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.
- D. Owner: An authorized representative of the Owner or the Owner's authorized consultant.

1.4 QUALITY ASSURANCE

- A. The work of this section shall be performed by a single firm experienced in irrigation work and holding a current California Contractor's A or C27 License.
- B. Qualifications of Workers
 - 1. The Contractor shall employ skilled workers who are thoroughly trained and experienced in irrigation system installation and who are completely familiar with the specified requirements and methods needed for proper performance of this work.
 - 2. The Contractor shall provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.

1.5 SUBMITTALS

- A. An operational assessment report of any existing irrigation system in the area of work shall be submitted prior to the start of the project's work, including demolition and clearing. See Subsection 1.07, F.
- B. The Contractor shall submit complete lists of proposed materials and equipment per the Division 01 Submittal Section, including manufacturer's name and model numbers. Only provide additional product data and/or catalog cut sheets if a substitute material or equipment is proposed. No substitution will be allowed without prior written approval.
- C. Shop drawings shall be provided for the layout and description of all equipment assemblies, including dimensions, capacities, and other characteristics as listed in product specifications. Shop drawings for booster pump assemblies shall clearly and neatly indicate the layout of the assemblies and proposed piping in the pump yard, and shall show adjacent equipment, required clearances, walls, fences, piping and other existing permanent improvements affecting the layout. Materials and equipment shall not be ordered until given written acceptance. Equipment or materials installed or furnished without prior approval or acceptance may be rejected and the Contractor shall be required to remove such materials from the site at his own expense.
- D. When specific name brands of equipment and materials are used, they are intended as preferred standards only. This does not imply any right upon the part of the Contractor to furnish other materials unless specifically approved in writing as equal in quality and performance by the Owner. Decisions by the Architect/Engineer shall govern as to what name brands of equipment and materials are equal to those specified on the plans and his decisions shall be final. It shall be the responsibility of the Contractor to furnish proof as to equality of any proposed equipment or material.
- E. Approval of any item, alternate or substitute indicates only that the products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- F. Acceptance of any submittals, deliverables, or other work product of the Contractor shall not be construed as assent that the Contractor has complied with, nor in any way relieved the Contractor of compliance with (i) the applicable standard of care, and/or (ii) applicable statutes, regulations, rules, guidelines, and contract requirements.
- G. Irrigation Equipment: When the Contractor desires to transfer salvaged irrigation equipment and/or new spare equipment and/or parts to the Owner, he must submit along with the equipment an itemized list. The Contractor is solely responsible to obtain a written confirmation by the Owner that all materials received by the Owner matches his material list. The transfer of materials will not be considered executed without written confirmation of same.

- H. Submit any required or requested testing data and/or Certificates, including but not limited to the backflow prevention assembly testing Certificate after the assembly is installed prior to regular system operation.

1.6 EXPLANATION OF DRAWINGS

- A. The intent of the drawings and specifications is to indicate and specify a complete and efficient sprinkler irrigation system ready for use in accordance with the manufacturer's recommendations, and all applicable local codes and ordinances. Interpretation of irrigation plans and specifications shall be the responsibility of the Landscape Architect or Owner.
- B. All existing systems and improvements are shown in their approximate locations. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and shall report any variations to the Owner.
- C. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all his work, and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between sprinkler systems, planting, utilities, and architectural features will be avoided. Locate pipe, valves and other equipment in planting areas unless specifically noted otherwise.
- D. All work called for on the drawings by notes shall be furnished and installed whether or not specifically mentioned in the specifications.

1.7 EXISTING CONDITIONS

- A. The Contractor shall not install the irrigation system and equipment as shown on the Drawings when it is obvious in the field that obstructions or differences in existing conditions and/or systems are present. Such obstructions or differences should be immediately brought to the attention of the Owner. Failure to provide notification prior to the start of this work shall make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage of the system without any additional cost to the Owner.
- B. The Contractor shall examine carefully the site of work contemplated and the proposal, plans, specifications, and all other contract documents. By submitting a bid, the Contractor attests that he has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and quantity of work to be performed and materials to be furnished, and the requirements of the specifications. The Contractor shall take necessary precautions to protect existing site conditions that are to remain. Should damage be incurred, the Contractor shall make the necessary repair or replacement to bring it back to its original condition at his own expense.
- C. Prior to cutting into the soil, the Contractor shall coordinate with the Owner to locate all cables, conduits, sewers, septic tanks, and other such underground utilities as are commonly encountered and he shall take proper precaution not to damage or disturb such improvements. If a conflict exists between such obstacles, notify the Owner who will consider realignment of the proposed work. The Contractor will proceed in the same manner if a rock layer or any other condition encountered underground makes change advisable. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown in plans.

- D. The Contractor shall verify the correctness of all finish grades within the work area in order to insure the proper soil coverage (as specified) of the sprinkler system pipes. The Contractor shall verify and be familiar with location and size of the proposed water supply (P.O.C.). He shall make approved type connection and install new work.
- E. The Contractor shall be responsible for notifying the Owner prior to installation that equipment or methods indicated on the drawings or in the specifications conflict with local codes, are incompatible or an error is apparent. If the event the Contractor neglects to do this, he will accept full responsibility for any revisions necessary.

1.8 PERMITS

- A. The Contractor shall obtain and pay required fees to any governmental or public agency. Any permits for the installation or construction of any of the work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. He shall also arrange for and pay all costs in connection with any inspections and examination required by these authorities.

1.9 TESTING

- A. General: Unless otherwise directed, tests shall be witnessed by the Owner. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered before such tests, the Contractor shall, at his expense, uncover, test and repair his work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.
- B. Main Line Piping: Hydrostatically test main line pipe segments after a minimum of twenty-four (24) hours after any solvent connections. Purge any free air in the test pipe sections. Partially backfill pipe but keep all joints exposed. Maintain 125 psi water pressure in new main line piping for a minimum duration of two (2) hours. There can be a maximum +/- 5psi change in pressure during the test.
- C. After being installed at the project site, any newly installed Backflow Prevention unit must be tested and approved as functioning properly per the local water agency requirements. Approval of the backflow prevention unit must precede any final inspection of the irrigation system. All costs for testing shall be the responsibility of the Contractor.

1.10 OBSERVATION

- A. General:
 - 1. Installation and operations must be approved by the Owner.
 - 2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Owner. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.
 - 3. In all cases, where inspection of the irrigation system work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner's Representative, the Contractor shall notify the Owner's Representative at least 48 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to have the required inspection, shall be performed at the Contractor's own expense.
- B. Periodic observations shall be required for basic operations and installations during progression of the project. The Owner's Representative, Owner or Landscape Architect shall perform the

observations and shall record the observation on the Irrigation System Observation Log form on the As Built Record Drawings. Such observations will include but not necessarily be limited to the following items as included in the scope of work:

1. Layout and flagging of sprinkler heads.
2. Trenching.
3. Main line installation.
4. Main line sustained pressure check.
5. Wire placement.
6. Partial fill compaction of trenches.
7. Control valve installation.
8. Drip line installation prior to backfilling.
9. Existing Irrigation controller programming for new planting zones.
10. Booster Pump installation or modification and start-up.
11. Sprinkler/emitter coverage prior to the start of planting operations.
12. Overall system operation and primary/secondary communication.

C. Coverage & Operations Review:

1. When the irrigation system is operational and prior to soil conditioning operations, the Contractor in the presence of the Owner shall perform a coverage test of the irrigation system. The Contractor shall furnish all materials and labor required to perform the coverage test and to correct any minor inadequacies of coverage disclosed. The Contractor shall inform the Owner and Owner of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage. If such notification of necessary corrections or additions to the irrigation system is not provided prior to or during the coverage test, the Contractor shall make all subsequent adjustments and corrections needed for proper coverage without any extra cost to the Owner.
2. Prior to the start of the maintenance period, the irrigation system shall be reviewed by the Owner for proper operations, and a review of and training on equipment and associated controls performed. Any corrections and/or adjustment shall be made as a condition for the start of the maintenance period and subsequent Final Acceptance.
3. Submit a Pump Start-up and Training Report after start-up. Include a copy in the O&M manual.

D. Final Acceptance: The work will be accepted in writing when the entire project improvements have been completed to the satisfaction of the Owner. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary for the Owner to occupy any portion of the work area before the contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner's separate work forces.

1.11 REJECTION OF NON-CONFORMING MATERIAL OR WORK

- A. The Owner reserves the right to reject any material or work which does not conform to the contract documents. The rejected material or work shall be removed or corrected by the Contractor at no additional cost to the Owner.

1.12 OPERATIONS AND MAINTENANCE INSTRUCTIONS & RECORD DOCUMENTS

- A. The Contractor shall prepare and deliver to the Owner's Representative within ten (10) calendar days prior to completion of the construction and as a prerequisite to the start of the maintenance period, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two individually bound sets of Operating and Maintenance Manuals. These manuals shall describe the material installed and shall be in sufficient depth to permit operating personnel to understand, operate and maintain all equipment. Spare part lists and related

manufacturer identification shall be included for each installed equipment item. Each complete, bound manual shall contain the following information:

1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of equipment, with names and addresses of local manufacturer representatives and warranty periods.
 2. The Contractor to issue a "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions and that the system functions properly.
 3. Complete operating and maintenance instructions and warranties on all major equipment.
 4. Complete set of manufacturer's literature and specifications of material installed, including parts list.
 5. A list of the controller station number for each control valve if different than the control valve number shown on the drawings.
 6. Initial electrical data on each control valve:
 - a. Ohms reading for each valve taken at the controller (circuit is OFF).
 - b. Voltage reading for each valve taken both at the controller and at the valve (circuit is ON).
 7. A booster pump assembly start-up report by the pump assembly manufacturer's representative. The start-up report shall at minimum include:
 - a. A list of attendees to the start-up procedure and training session.
 - b. Record of pump parameters and settings.
 - c. Notes regarding any incomplete or non-compliant installation, equipment, communication or other work items related to the integration of the pump assembly into the overall irrigation system.
 - d. A schedule of recommended maintenance activities.
 - e. Customer service contact information for maintenance checks and warranty repairs.
- B. The contractor shall furnish one set of As-Built full-scale drawings on bond, and two compact disks with complete sets of digital PDF files of all close-out documents after the As-Built Record Drawings have been reviewed and accepted by the Landscape Architect.
1. Label first page of each document, or set of documents, "AS-BUILT PROJECT RECORD" in neat large printed letters on lower right hand corner. Record information concurrently with construction progress. Prints for this purpose may be obtained from the Owner. This set of drawings shall be kept on the site and shall be used only as a record set. Do not conceal any work until required information is recorded. These drawings shall also serve as work in progress sheets, and the Contractor shall make neat and legible annotations thereon daily as the work progresses, showing the work as actually installed. These drawings shall be available at all times for inspection and shall be kept in a location designated by the Owner.
 2. Drawings: Legibly mark to record actual construction:
 - a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and depth of each concealed line or item. Accurately locate each capped, plugged or stubbed line.
 - b. Field changes of dimension and detail.
 - c. Changes made by Field Order, Addenda, or other change document.
 - d. Show the final controller station number for each control valve if different than the control valve number shown on the drawings.
 3. Deliver all Close-out Documents (As-Built) to the Owner. Accompany submittal with transmittal letter in duplicate, containing:
 - a. Date.
 - b. Project title.
 - c. Contractor's name and address.
 - d. Title and number of each Record Document (As-Built).

- e. Signature of Contractor or his authorized representative.
- C. The Contractor shall provide controller chart(s) as follows:
 - 1. The Contractor shall provide two controller charts for each controller's area of work.
 - 2. The chart shall show the area of work controlled by the automatic controller and shall be the maximum size that the controller door will allow.
 - 3. Show the controller station number for each control valve if different than the control valve number shown on the drawings.
 - 4. The chart may be a reduced drawing of the actual as-built system. However, in the event the valve numbering is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
 - 5. The chart shall be colored with a different permanent color for each station.
 - 6. The chart shall be enclosed in a waterproof envelope or laminated.
- D. Per MWELO Section 492.9, upon completion of the landscape planting and irrigation system, and as a condition of Final Acceptance and/or the issuance of a Certificate of Occupancy, the licensed landscape contractor shall submit to the approving agency and/or Owner, the following items in a form acceptable to the approving agency and/or Owner:
 - 1. Project information and contact information for the Owner and Applicant (Contractor).
 - 2. Certification that the installation complies with the approved Landscape Documentation Package.
 - 3. Irrigation scheduling parameters used in programming the controller during the establishment and maintenance periods.
 - 4. A Schedule of Irrigation System Maintenance.
 - 5. A Landscape Irrigation Audit Report per MWELO Section 492.12. Provide the Audit Report unless the report is not required by the approving agency or Owner.

1.13 SPARE PARTS AND EQUIPMENT

- A. Prior to the conclusion of the maintenance period, furnish the Owner with the following spare parts and equipment:
 - 1. One quick coupler key with attached hose swivel for each set of four quick coupler valves installed.
 - 2. Ten spare nozzles for each different sprinkler head arc and/or radius nozzle installed.
 - 3. One valve key for the 2" operating nut and/or hand wheel isolation valve.
 - 4. One hundred feet of in-line emitter tubing with ten straight and ten ninety degree compression fittings.
 - 5. One functional Universal controller remote programmed to operate the system controllers.

1.14 WORK AREA AND SAFETY

- A. The Contractor shall furnish, erect, and maintain all temporary facilities; perform all temporary work during the period of construction, including those herein specified. All facilities shall be maintained in proper and safe operating and sanitary conditions at all times.
- B. The Contractor shall comply with the provisions of the Construction Safety Orders, and General Safety Orders issued by the State Division of Industrial Safety, as well as all other applicable laws, ordinances and regulations.
- C. The project site shall be maintained in a neat and safe condition at all times. Cleanup shall be accomplished as the work progresses and upon completion of the work. The Contractor shall provide adequate safety measures to protect workers and the public from injury.

1.15 GUARANTEE

- A. Irrigation system consisting of materials, equipment and workmanship shall be guaranteed for proper operation a minimum of one year from date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later. Manufacturer's warranty periods may be longer, and shall be noted in the close-out documents.
- B. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects of materials, equipment or workmanship one year from the date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later.
- C. The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the Guarantee as herein specified.
- D. The Booster Pump Assembly shall have a minimum 3 year warranty with no-cost annual service checks over the Warranty Period. See the Booster Pump Assembly and Controls execution section for additional requirements.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Schedule rated white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1785.
- B. Class rated (Standard Dimension Ratio) white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1784.
- C. PVC pipe shall be of the Class or Schedule as follows:
 - 1. PVC pipe shall meet ASTM D-2241 for solvent weld, plain end, ASTM D-2672 for solvent weld, bell end, and ASTM D-3139 for gasketed bell end. Pipe shall be of the Schedule and/or Class as indicated herein.
 - 2. Pipe sleeves under paving shall be PVC Schedule 40 for 3-inch and smaller or SDR 35 for 4-inch and larger pipes.
 - 3. Riser and/or manifold pipe connecting valves to main line fittings shall be Schedule 80 PVC.
 - 4. Pressurized main line pipe shall be Schedule 40, belled end with solvent welds for pipe sizes less than 2 inches. Pipe sized 2 inches and greater shall be Class 200, SDR 21, with gasketed bell ends.
 - 5. Non-pressurized lateral line pipe shall be Schedule 40, belled end with solvent welds.
- D. All pipes shall be continuously and permanently marked and conform with the following information: manufacturer's name or trademark, nominal pipe size, Schedule or Class of pipe, pressure rating in PSI, ASTM designation and (NSF) seal of approval.
- E. Rigid polyvinyl chloride (PVC) Fittings:
 - 1. White Schedule 40 type I and II grade 1, solvent weld socket fittings ASTM D-2466 for all lateral lines 2-1/2 inches and smaller.
 - 2. Gray Schedule 80 type I and II grade 1 solvent weld socket fittings ASTM D-2464 for all main line less than 2 inches diameter, and lateral lines 3 inches and larger.
 - 3. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable (IPS) schedule, and (NSF) seal of approval.

4. All plastic fittings and connectors shall be injection molded of an improved polyvinyl chloride compound featuring high tensile strength, high chemical resistance and high impact strength in terms of current ASTM standards for such fittings. Where threads are required in plastic fittings, these shall be injection molded also.
- F. PVC Solvent Weld Adhesive: All socket and bell type connections shall be joined with primer and PVC solvent cement which shall meet the requirements of ASTM F656 for primer and ASTM D2564, "Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings." Solvent cement joints for plastic pipe and fittings will be made as prescribed by manufacturer. The high chemical resistance of the pipe and fitting compounds specified in the foregoing sections makes it mandatory that an aggressive colored primer, which is a true solvent for PVC be used in conjunction with a solvent cement designed for the fit of pipe and fittings specified. A heavy bodied, medium set solvent cement, e.g. Weld-On 711 gray, shall be used for all classes and schedules of pipe and fittings.
- G. PVC Pipe Thread Sealant: A non-hardening all purpose sealant and lubricant similar to Permatex #51 or Lasco blue pipe thread sealant which is certified by the manufacturer to be harmless to PVC pipe and fittings. Apply sealant to clean male threads, brushing into grooves and to the first three threads of the female threads. A good quality grade of teflon tape recommended by the manufacturer for use with plastics may be used in lieu of sealant. Minimum width of tape to be used is 3/4". A minimum of two wraps and a maximum of three wraps to be used.
- H. PVC Swing Joints: Connections to sprinkler heads from lateral lines shall be made with swing joints as detailed. Pre-assembled swing joints from Hunter, King Brothers or Spears are acceptable.
 1. Use 6" length nipples for 1/2 inch inlet heads.
 2. Use 12" length nipples for 3/4 or 1 inch inlet heads.
- I. Coated Ductile Iron pipe and fittings:
 1. Ductile Iron pipe shall be centrifugally cast pipe conforming to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with cement - mortar lining and seal coating per ANSI/AWWA C104/A21.4.
 2. Ductile Iron flanged pipe shall conform to ANSI/AWWA C115/21.15.
 3. Ductile Iron flanged fitting to PVC pipe shall use a 'Megalug' mechanical joint restraint Series 2000PV by EBAA Iron per either ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21.53, or equal.
 4. Joints shall comply with the following standards:
 - a. Rubber gasketed/mechanical joints: ANSI/AWWA C111/A21.11.
 - b. Flanged joints: ANSI/AWWA C110/A21.10, B16.1, B16.2.
- J. Coated ductile iron push-on mechanical fittings meeting ANSI/AWWA C110 or C153/A21.10 shall be used for:
 1. Main line connections for pipe 4 inches and greater in diameter.
 2. New main line service tee at valve connections.
 3. Self-restrained fittings or joint restraints (Leemco LH or equal) shall be used for all elbows, tees, bends, etc fittings.
- K. Coated ductile iron service saddles with stainless steel double straps, Smith-Blair 317, Romac Industries 202NS, or equal, shall be used for remote control/quick coupler valve service connections on main lines 1.25 inch or greater, and where the available outlet size can match the largest lateral line size downstream of the remote control valve.
- L. Galvanized pipe and fittings:
 1. Galvanized Pipe shall be hot dip galvanized continuous welded, seamless steel SCH 40 pipe conforming to current ASTM A53 standards.

2. Galvanized Fittings shall be galvanized, threaded malleable iron SCH 40 conforming to current ASTM A865 standards.

2.2 BACKFLOW PREVENTION ASSEMBLY

- A. The backflow prevention assembly is existing and shall remain in place.

2.3 VALVES

- A. Electric Control Valves:
 1. Globe valves operated by low-power solenoid, normally closed, manual flow adjustment. Sizes and types as shown on drawings.
 2. Provide a pressure regulating module on all control valves, or other pressure regulating components as part of the operating spray head or low volume head zones when the dynamic system pressure is, or may be greater than 45 psi.
- B. Electric Master Valves:
 1. The master valve is existing and shall remain in place.
- C. Control Valve Marking: Christy's valve identification tag (or equal), yellow color with text designating controller and valve station number, e.g. "A12", or equivalent.
- D. Isolation Valves:
 1. Cast bronze, coated ductile iron or coated cast iron gate valve with resilient wedge, non-rising stem and two inch operating nut for main line 2 inch size or greater. Match size of mainline.
 2. Cast bronze threaded gate valve with bronze cross handle for main line less than 2 inch size.
- E. Quick Coupling Valve: Two piece quick coupling valve as shown on the Drawings.

2.4 VALVE BOXES

- A. Control Valve/Master Valve/Flow Sensor boxes:
 1. Shrub/Ground Cover areas: Carson 1419 body with lockable tan plastic cover, or equivalent. Drip Valve Kits shall use a Jumbo body with lockable tan plastic cover.
 2. Turfgrass areas: Carson 1419 body with lockable green plastic cover, or equivalent.
 3. Hardscape areas: Christy B16 concrete box (11.75" x 22.25") with N16R composite lid, or equivalent.
- B. Quick Coupler Valve boxes:
 1. Shrub/Ground Cover areas: Carson 910 body with lockable tan plastic cover, or equivalent.
 2. Turfgrass area: Carson 910 body with lockable green plastic cover, or equivalent.
- C. Isolation Valve boxes:
 1. Gate Valve box in hardscape: Christy G05 round concrete valve box (10.375" ID) with cast iron G05C lid, or equivalent.
 2. Gate Valve box in planting areas: Christy F08 round concrete valve box (8" ID) with F08R concrete lid, or equivalent. Use F14 ADS adapter and extension for sizes 2.5 inches and larger.
 3. Ball Valve box: Same as 2.04, A.

- D. Control Valve box marking: Plastic lids shall have a branded markings, and concrete lids shall have an embossed, anodized aluminum labels permanently attached to the top of lid with minimum 1" high letters showing controller letter and station number.

2.5 CONTROLLER

- A. The irrigation Controller is existing and shall remain in place. Verify open stations and spare wire, if any, in the area of work.

2.6 UNIVERSAL HANDHELD REMOTE

- A. Remote unit shall be able to have complete control over any solid state or electro/mechanical controllers. Unit shall have a minimum range of one mile from transmitter to the receiver.
- B. Remote unit shall be capable of coded FM transmissions which eliminate unwanted interference and works amid buildings or hilly terrain.
- C. Receiver board shall be integral to the controller unit. The receiver antenna shall be integrated into the controller enclosure.

2.7 CONTROL AND TRACER WIRE, COMMUNICATION CABLE

- A. Connections between the automatic controllers and the electric control valves, and tracer wire shall be made with direct burial AWG – UF 600 volt copper wire manufactured for irrigation system use.
- B. Hot control wires for the first controller shall be red. If multiple controllers are installed, the hot wire color shall be orange, yellow, purple in order for each controller. Common ground wire shall be white, with a color stripe corresponding to the hot control wire color when multiple controllers are installed. Spare control wires shall be black and spare common wire blue. Tracer wire shall be green.
- C. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14. Common wire shall be a minimum #12 size.
- D. All control wire splices/caps shall be made with direct bury rated, waterproof wire connectors with silicone sealant, Spears DS-500 Dri-Splice, 3M DBR/DBY or approved equal. Use one splice per connector sealing pack.
- E. Apply waterproof numbered wire markers or sleeves at both sides of all splices and at the controller terminal board corresponding to the controller (A, B, etc.) and station number (02, 14, etc.). If multiple valves are connected to one station, add a single digit identifier (1, 2, etc.) to the station number (XX), e.g. A02-1, A02-2, etc.
- F. Communication/flow sensor cable shall be a shielded and jacketed, minimum 16 gauge twisted pair with drain wire, Paige P7162D or equal compliant with the controller manufacturer's specifications.
- G. Below-grade conduit for control wires and/or cables shall be PVC for electrical use with long radius sweeps at direction changes and at valve/splice/pull box terminations.

2.8 IRRIGATION HEADS

- A. Spray/Bubbler Pop-up Head: Molded plastic body with pop-up plastic riser and nozzle. Refer to schedule on drawings. Manufacturer's model numbers are listed with description.
- B. Rotor Pop-up Head: Molded plastic body with plastic riser and nozzle, stainless steel clad riser if specifically noted or standard. Gear driven rotation with memory arc, balanced nozzle sets. Manufacturer's model numbers are listed with description.

2.9 DRIP IRRIGATION EQUIPMENT

- A. Flexible distribution tubing shall be 0.66" - 0.70" OD (17mm nominal) fabricated from virgin polyethylene resin specifically designed for subsurface drip irrigation use and conforming to ASTM D 1248 for Type I, Class C, Category 4 Grade P14, and to ASTM D-3350 for PE 122111C. Provide all fittings, connectors and accessories compliant with the tubing for a complete, properly functioning system.
- B. Pressure rating of tubing shall be as defined in Standard ASAE S435. Burst strength shall be minimum 50 psi at 176 degrees F for 4,200 hours.
- C. In-line wye filters shall be type as noted on the Drawings. Filter element shall be molded polyester screen cylinder with minimum 150 mesh screen (blue).
- D. Preset pressure regulators shall be type as noted on the Drawings for above or below ground application.
- E. In-line emitter tubing shall be a below grade product with self-cleaning emitters. Manufacturer as noted on the Drawings.
- F. Flush valve as noted on drawings.
- G. Operation indicator shall be a 6 inch pop-up sprinkler body with built-in check valve. Install a bubbler or variable arc nozzle that can be adjusted to a no-flow condition, Hunter ECO-INDICATOR, or equal.

2.10 BOOSTER PUMP ASSEMBLY AND CONTROLS

- A. Pump shall be a variable frequency drive (VFD) type and shall provide high efficiency and stable operating pressure (flat curve and low relative shut-off head should not exceed normal operation TDH by more than 30%) at the prescribed flows.
- B. Electrical power supply shall be 480 AC volts, 60Hz, triple phase. Provide an electrical service disconnect with fuses of appropriate amperage as part of the control panel.
- C. Welded or grooved steel or brazed/soldered copper tubing piping systems shall be provided. Threaded connections are allowed only at the interface of threaded mechanical appurtenances.
- D. All above-grade piping shall be sized to maintain velocities below seven-and-a-half feet (7.5') per second.
- E. Valves shall be 200 PSI rated, epoxy coated ductile iron resilient wedge gate valves, conforming to WWA C509 Standards.

- F. Bypass piping and valves shall be included in order to isolate the pump while providing non-boosted flow. Bypass check valve shall be flanged or wafer-style silent check valve in order to minimize water hammer during pump cycling.
- G. Inlet and discharge pressure gauges shall be two inches (2") stainless chased, glass faced, liquid filled and installed with gauge cocks (range to be minimum of 50% greater than normal operating pressure).
- H. The VFD pump control panel shall be UL certified. The panel shall have a manual disconnect switch. The controls shall have digital readouts with a touch screen, minimum 320 x 240 pixel backlit operator interface, and be housed in a minimum NEMA 3R weatherproof enclosure. The unit shall have an across-the-line type magnetic starter and overload protection. Minimum control provisions shall incorporate programmable logic control (PLC) such as phase failure (low and high voltage) protection, time-delayed start, low supply low pressure and low/no flow safety control circuits. Control program shall enable variable pressure and/or flow set points for both pump activation and/or discharge pressure.
- I. The VFD unit shall be activated by user selection of either:
 - 1. The controller's pump start feature (station or program based) through the installation of a 24-volt AC pump start relay of sufficient amperage rating for the system, or
 - 2. A user defined line pressure drop through a pressure switch relay.
 - 3. A user defined flow rate through a flow switch relay.
- J. Integrate the VFD control panel into the pump assembly structure. Where the existing space available for access to the pump control panel is problematic, the pump control panel may be surface mounted adjacent to the booster pump assembly where space and structure permits with the approval of the Owner.
- K. The pump assembly shall have a normally open master valve/reed switch flow sensor combination hydrometer (Netafim, Bermad) integrated into the discharge piping to provide flow data and master valve control to/from the irrigation controller.
- L. The pump assembly shall be an integrated unit on a steel support structure with a powder coated enclosure.
- M. Acceptable pump assembly vendors are:
 - 1. Precision Pumping Systems, Boise, ID. 208-323-5300; Rob Aldinger.
 - 2. Site One Green Tech, Rocklin, CA. 925-451-1610; Jim Weller.

2.2 CONCRETE

- A. Cast-in-place Portland cement concrete used for pipe encasement, cover, thrust blocks, pipe support or other below-grade use shall at minimum comply with 2,800 psi 28 day strength.

2.3 OTHER MATERIALS

- A. Materials not specifically indicated but necessary for the proper execution of this work shall be of first quality as selected by the Contractor subject to the acceptance of the Owner.

- B. All materials appearing in the legend and details of the irrigation drawings are to be furnished and installed by the Contractor unless specifically noted to the contrary. Contractor is responsible for installation according to plans and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.
- C. Granular bedding material shall be clean natural occurring sand, free from clay, salt, sea shells or organic material, suitable for the purpose intended, and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve.

PART 3 - EXECUTION

3.1 SYSTEM DESIGN AND VERIFICATION

- A. Contractor shall verify existing pressure and any existing irrigation equipment, and shall inform the Owner of any discrepancies between the existing systems' make and model of equipment, such as sprinkler heads, control valves, etc., and those indicated in the Drawings in writing prior to the start of irrigation system installation. Failure to inform the Owner of any discrepancy within seven working days prior to beginning of system installation will place the responsibility of any and all corrective action on the Contractor at no expense to the Owner.

3.2 PIPING INSTALLATION

- A. General:
 - 1. Any equipment installed by the Contractor and deemed to be for the use of the Owner in various situations (i.e., control valves, control panels, etc.) shall be so installed to be readily accessible and quickly operable. Equipment deemed by the Owner to be inoperable for its intended purpose shall be reinstalled by the Contractor in an operable position before approval will be given. Any changes made by the Contractor shall be done without any additional cost to the Owner.
 - 2. The Contractor shall be responsible for layout of proposed facilities and any minor adjustments required due to differences between existing conditions and the Drawings. Any such deviations in layout shall be within the intent of the original drawings, and without additional costs to the Owner. The Owner will indicate the proposed precise location of the control panels. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Where head spacing is not specifically noted, Contractor shall install sprinkler heads evenly along the irrigation area's perimeter. Flush all lines prior to installation of heads.
 - 3. Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance to manufacturer's recommendations to allow for expansion. Lay on solid bedding, at uniform depth.
- B. The Contractor shall examine all other portions of working drawings and plan trenching and pipe layout so that no conflict will arise between irrigation and any other work. Any corrective action will be the Contractors responsibility at no further expense to the Owner.
- C. Excavations:
 - 1. Excavations shall be open vertical construction, sufficiently wide to provide clear working space around the work installed and to provide ample space for backfilling and tamping.
 - 2. The use of a vibratory plow or methods other than open vertical trenching will not be allowed without the written approval of the Owner. To obtain such approval, a field test must be performed, at the proposed site, with the equipment to be used in the presence of the Owner and Owner. The field test is to indicate if the proposed site is favorable to the plowing method. Approval for plowing at one location does not allow the use of plowing at another location. Approval for plowing must be obtained for each location

where the use of plowing is proposed. If, at previously approved plowing locations, conditions for plowing become unfavorable as determined by the Owner, plowing shall be terminated.

3. Trenches for pipe and equipment shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the line.
4. Unless written approval for using native soils as bedding material is given by the Owner, main line pipe shall be placed on a minimum 6 inch depth of granular bedding material.
5. Excess trench soil with rocks greater than ½ inch diameter shall be removed from the planted area and spread as directed by the Owner.
6. When two pipes are to be placed in the same trench, it is required to maintain a minimum four inch (4") horizontal separation between pipes.
7. Depth of trenches shall be sufficient to provide a minimum cover above the top of the pipe as follows:
 - a. 24-inch minimum over main lines.
 - b. 18-inch minimum over non-pressure (rotary pop-up) lateral lines.
 - c. 12-inch minimum over non-pressure (pop-up spray head) lateral lines.
 - d. 24-inch minimum over any lines located out in road surface area of paved streets.
 - e. Maximum cover above the top of the pipe shall not exceed twelve inches (12") greater than the required minimum cover.
 - f. 12-inch minimum cover over drip line non-pressure lateral lines.
 - g. 3-inch minimum cover over in-line emitter tubing.

D. Assemblies:

1. Routing of pressure supply lines as indicated on drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with details on plans.
2. Install all assemblies specified herein according to the respective detail drawings or specifications pertaining to specific items required to complete the work. Perform work according to best standard practice.
3. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
4. All threaded pipe and fittings shall be assembled using an approved teflon tape, or equivalent, applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved teflon tape will be required.
5. No main line elbows, branch tees or isolation valves are to be located closer than five (5) feet to each other without prior approval of the Owner.

E. Line Clearance: All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Plastic to Steel Connections:

1. At all plastic (PVC) pipe connections, the Contractor shall work the steel connections first. Connections shall always be plastic into steel, never steel into plastic. An approved teflon tape shall be used on all threaded (PVC) to steel, never steel into plastic. An approved teflon tape shall be used on all thread (PVC) to steel pipe joints applied to the male threads only, and light wrench pressure is to be applied. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved 3/4" wide teflon tape will be required.
2. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

G. Plastic Pipe:

1. The Contractor shall exercise care in handling, loading, unloading, and storing plastic pipe and fittings. All plastic pipe and fittings shall be stored under a weatherproof roofed structure before using and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lie flat so as not to be subject to undue bending or concentrated external load at any point.

- a. All lumber, rubbish, rubble, concrete and rocks shall be removed from the trenches by the Contractor. Pipe shall have a firm uniform bearing for the entire length of each pipe line to prevent uneven settlement. Wedging or blocking under riser tees shall be done only if specified on the plans. Pad trenches with soil as necessary to provide uniform bearing surfaces.
 - b. Where extensive lengths of pipe are installed, snake pipe in trench from side to side to allow for expansion and contraction. One additional foot per one hundred (100) feet of pipe is the minimum allowance for snaking. Never lay pipe when there is water in the trench or when the temperature is 32 degrees F or below.
 - c. All changes in direction of pipe shall be made with fittings, not by bending. No main line fittings for changes in direction shall be greater than 45 degrees. Provide a minimum five (5) feet between changes in direction elbows.
 - d. Safely handle primers and cements per ASTM F-402. Make solvent weld joints per ASTM D-2855 with a non-synthetic bristle brush in the following sequence:
 - 1) Make sure pipe is cut square and all rough edges and burrs are removed. All connecting surfaces are properly cleaned and dry prior to application of pipe primer.
 - 2) Apply an even coat of colored primer to pipe and fitting prior to application of solvent.
 - 3) Apply an even coat of solvent to the outside of the pipe, making sure that the coated area is equal to the depth of the fitting socket.
 - 4) Apply an even light coat of solvent to the inside of the fitting.
 - 5) Apply a second coat of solvent to the pipe.
 - 6) Insert the pipe quickly into the fitting and turn pipe approximately one-eighth to one-quarter turn to distribute the solvent and remove air bubbles. Hold the joint for approximately fifteen seconds so the fittings do not push off the pipe.
 - 7) Using a clean rag, make sure to wipe off all excess solvent to prevent weakening at joint.
 - 8) Exercise care in going to the next joint so that pipe is not twisted, thereby disturbing the last completed joint.
 - 9) Allow at least fifteen minutes setup time for each welded joint before moving.
 - 10) Repairing plastic pipe when damaged shall be done by replacing the damaged portion of pipe.
- H. Concrete Thrust Blocks: Concrete anchors or thrust blocks shall be provided on pressure main pipelines 2 inches or greater in diameter at abrupt changes in pipeline grade, changes in horizontal alignment (bends, tees and crosses), reduction in pipe size (reducers, reducing tees or crosses), end-line caps or plugs, and/or in-line isolation valve to absorb any axial thrust of the pipeline. The pipe manufacturer's recommendation for thrust control shall be followed. Thrust blocks must be formed against solid unexcavated earth (undisturbed). Do not enclose entire joint in concrete. Provide a minimum of two cubic feet of concrete for each thrust block.
- I. Concrete thrust blocks may be eliminated if the main line piping system uses self-restrained fittings and bell joint restraints throughout.

3.3 PIPE DEPTH AND BACKFILL

- A. Backfill shall not be placed until the installed system has been inspected, pressure tested and approved by the Owner.
- B. Backfill for first 6 inches underneath, and 4 inches around and above main line pipe and control wires shall be granular bedding material, unless the Owner approves in writing that native soil may be used for initial backfill in lieu of granular bedding material. Backfill material for the upper portion of the trench shall be approved soil. Unsuitable material, such as pipe remnants and wire

including clods and rocks over two inches (2") in size, shall be removed from the premises and disposed of legally at no cost to the Owner.

- C. Backfilling for all pipe shall be carried out in two basic stages.
 - 1. Stage One Backfilling: This shall be accomplished as soon as possible after the pipe is laid. A bedding of uniform depth with no voids must be provided along the entire length of the pipe. The bedding material should be placed in the trench and tamped into the areas under the pipe, using a suitable tool. Joints should be left exposed until hydrostatic tests are completed. Cover only those portions of the pipe necessary to prevent movement or damage.
 - 2. Stage Two Backfilling: This shall be completed after all hydrostatic tests are completed and the piping system has been thoroughly checked for leaks or other defects. Continue to add backfill material in four inch (4") layers and hand tamp to achieve density similar to adjacent soil. After twelve inches (12") in main line trenches and eight inches (8") in lateral line trenches of hand tamped soil is in place over the pipe and fittings, backfilling can be continued, using light machinery to place dirt in the trenches in six inch (6") layers and to compact the dirt to conform to adjacent soil. Extreme care should be taken to avoid damage to the pipe from machinery that is too heavy. All trenches shall then be water jetted to assure uniform settling and compaction. Backfilling operations will not be considered complete until the top surface has been graded to conform to the adjacent soil. All rocks uncovered and not used as backfill must be collected and removed from the site.
- D. All backfilling shall be done carefully and shall be properly tamped. All soil shall be tamped and puddled to eliminate any voids.
- E. Surplus earth remaining after backfilling shall be disposed of as directed by the Owner.
- F. PVC piping and fittings shall not be backfilled during periods of extreme heat or when a sudden lowering of temperature of the pipe may cause separation of joints or fittings.
- G. Contractor shall fill with properly amended topsoil any irrigation trench that subsides during the warranty period. Contractor shall assume all cost associated with the trench repair, including but not limited to plant replacement of a size of plant disturbed at the time of the repair.

3.4 BACKFLOW PREVENTION ASSEMBLY

- A. Check the existing backflow assembly for leaks or any improper condition. Notify the Owner as such if found.

3.5 CONTROL AND TRACER WIRE

- A. Protect wire by running alongside of mainline piping. Do not tape wire together when encased in sleeve. Minimum cover shall be 24 inches. Crimp wires together at valve manifold with Scotchlok connector. Conventional valve wire splices shall use a 3M DBY splice kit. Tag all control wire at splices with approved control wire markers.
- B. Wire size shall be determined by the number of valves operating on a given wire and the distance from the controller to the farthest valve, as specified by the charts furnished by the remote control valve manufacturer. Splices are only allowed when rerouting or repairing existing wire. All splice connections must be provided in a valve box.
- C. Install tracer wire along the top of pipe at the following locations:
 - 1. All pipe sleeves.
 - 2. Main line pipe without adjacent control wire.

3.6 VALVES

- A. The Contractor shall make all necessary connections for operation, and shall be connected and aligned to provide the most efficient flow of water to the irrigation heads. Where pressure regulating electric control valves are specified, the Contractor shall adjust the valve so a uniform distribution of water is applied by the heads, and that the most remote heads operate at the pressure recommended by the head manufacturer.
- B. Each valve is to be enclosed in a separate valve box. The valve box shall be secured on firm soil clear of valves and wiring connections. Valve boxes and lids shall be set to finished grade or as indicated on the Drawings. Use valve box extensions of the same material as the box to the proper depth below the pipeline. Valve boxes shall be supported by common bricks at each corner and at the long side of the box. Use a minimum of six bricks to support rectangular boxes and four bricks to support round boxes. Backfill carefully and properly compact in order to prevent settlement and subsequent damage.
- C. Install a concrete collar around valve boxes when located in asphaltic concrete pavement or in turfgrass areas.
- D. When existing valve and/or splice boxes are within the area of work, replace in kind any damaged boxes and/or lids, unless noted otherwise. Adjust the elevation of all existing boxes within the area of work to final grade per the drawings.
- E. Locate valve boxes in ground cover/shrub planting areas instead of turfgrass areas whenever possible. Locate valve boxes 18" from and perpendicular to adjacent paving. When grouped together, provide equal spacing of at least 36" between boxes.
- F. Permanently attach the plastic valve identification tag to the remote control valve body and locate so it's clearly visible in an open valve box.
- G. Permanently secure the control valve identification label to the top of the valve box lid with non-corrosive connectors.

3.7 AUTOMATIC CONTROLS

- A. Install the controller and/or associated equipment, enclosure, sensors, **decoders** and accessories per the manufacturer's details and installation requirements, and the construction documents.
- B. Connect operational control wires or accessory components to the controller, and program valve schedules appropriately for the new planting.
- C. The Owner shall review the fully functional operation of the irrigation control system prior to acceptance of the system, and as a requirement for the start of maintenance.
- D. Install automatic controller chart in laminated or watertight plastic envelope inside controller cover showing which valves are connected to which stations on controller in the work area.

3.8 ELECTRICAL SERVICE

- A. Electrical service shall be provided to the booster pump location by the electrical subcontractor. The irrigation subcontractor shall make the electrical power connection to the booster pump per code requirements.
- B. Install grounding rods, plates, etc. per manufacturer's and CEC code requirements.

3.9 SPRINKLER HEAD INSTALLATION

- A. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Flush all lines prior to installation of heads.
- B. Overhead distribution sprinkler heads shall be installed as detailed, set adjacent to the edge of hardscape elements (2 - 4 inches for spray heads, 6 - 8 inches for rotary heads) and perpendicular to the finish grade. Sprinkler spray heads directed toward a building shall be a minimum 7 feet from building walls, and a minimum 2 feet when directed away from the building. Sprinkler heads in turfgrass areas shall have a minimum 10 foot radius except for corners.
- C. The top of the nozzle in pop-up bodies shall be flush to the finish grade in areas to receive turfgrass seed/stolons, and in ballfield skinned infields. The top of the nozzle shall be one-half inch (1/2") above the finish subgrade in areas to receive standard cut turfgrass sod.
- D. High speed or other sprinkler heads in dust control zones at ballfield skinned infields shall be installed in turfgrass areas where directly adjacent to the skinned infield.
- E. Where individual shrub bubblers are installed, each plant shall have a bubbler within 10 - 14 inches of the shrub center.
- F. Upon completion of the installation, the Contractor shall adjust or change sprinkler head nozzles to uniformly distribute water without overspray and shall place entire irrigation system in first-class operating condition without any additional cost to the Owner.
- G. Sprinkler heads shall be adjusted in order by fully opening the sprinkler furthest from the control valve and working back toward the control valve. Adjust sprinkler heads which spray toward buildings or adjacent hardscape so that water spray does not contact the side of buildings or significantly over-spray onto hardscape.

3.10 DRIP IRRIGATION SYSTEM

- A. Install control valves, wye strainer, pressure regulator and rigid PVC lateral distribution lines or manifolds prior to planting soil conditioning operations.
- B. Install in-line emitter tubing as follows:
 - 1. After planting soil has been amended, tilled and rough graded, remove and stockpile the planting soil to the required depth of the in-line tubing, and install and stake drip tubing taking into account adjustments needed in the tubing location based on the planting layout. Stake in-line tubing at every-other emitter. Install flush and air relief valves, and operation indicator. Install the operation indicator on the supply manifold with a swing joint in a location easily visible by maintenance personnel.
 - 2. After system flushing, verification of proper operation and inspection, reinstall the stockpiled planting soil and finish grade to final elevation.
- C. Operate the system to moisten the planting soils prior to planting operations.
- D. Program the controller to operate the drip system using the controller's "cycle and soak" feature in order to apply the required daily watering amount in three equal cycles with a one hour delay between cycles..

3.11 CONCRETE

- A. Concrete shall be installed in accordance with the relevant portions of the Site Concrete specification section.

3.12 COMPLETION AND MAINTENANCE

- A. After the system has been completed but prior to the start of maintenance, the Contractor shall operate the automated system with the Owner, shall instruct the Owner in the operations and maintenance of the system and controls, and shall program the controller for each station.
- B. If site satellite controller(s) for a central control system is installed, an authorized central control distributor/installer shall program the central base station to communicate with the site satellite controller(s), and shall verify that proper communication protocols are operational.
- C. The irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the maintenance period or until Final Acceptance of the project, whichever is greater. Irrigation system maintenance shall commence upon an acceptable review following the completion of irrigation installation, planting operations and general clean-up.
- D. The maintenance period shall not terminate until the close-out documents and as-builts record drawings have been submitted and accepted.

3.13 REPAIR AND CLEAN-UP

- A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to new planting and improvements. Disturbed and/or damaged areas shall be restored to their original condition to the satisfaction of the Owner.
- B. Where trenching or other work disturbs newly planted turfgrass or planting, the Contractor shall reinstall the existing sod if viable, or install a full width of new turfgrass sod or planting to match the existing turfgrass/planting species/variety and size, after first conditioning the top 6 inches of soil per the Landscape Planting specification. Adjust finish grades to account for the new turfgrass sod's soil mat so that the new sod is flush to the adjacent turfgrass.
- C. After the irrigation operations are completed, the Contractor shall remove all trash, excess materials, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired or material replaced at the Contractor's expense. The site shall be left in a neat and orderly condition to the satisfaction of the Owner.

END OF SECTION

SECTION 32 90 00 LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall furnish all material, labor and equipment necessary to install all landscape work as indicated in the plans and specifications.
- B. The landscape work includes but is not necessarily limited to the following:
 - 1. Soil preparation including cross ripping of all planting soil.
 - 2. Weed control including an application of a pre-emergent herbicide.
 - 3. Providing import planting topsoil at raised grade planters and/or at planting areas needing fill.
 - 4. Fine grading, conditioning and amending planting topsoil.
 - 5. Installation of turfgrass sod and/or seed.
 - 6. Planting new trees, plants and ground covers.
 - 7. Tree drainage sump boring and testing.
 - 8. Root Barriers.
 - 9. Installation of mulch.
 - 10. Ninety (90) day maintenance.
- C. Related Work Specified Elsewhere
 - 1. Contract Drawings, Addenda, general provisions of the Contract, including General and Supplemental Conditions, and Division 1 Sections apply to work of this section.
 - 2. Section 31 20 00 - Earthwork
 - 3. Section 31 22 22 - Soil Materials
 - 4. Section 32 01 90 – Existing Landscape Protection
 - 5. Section 32 84 00 - Irrigation System

1.2 DEFINITIONS

- A. Unless noted otherwise, the term "approved" shall mean by the Owner in writing.
- B. Agencies and Organizations:
 - 1. ASTM- American Society for Testing and Materials
 - 2. ANSI – American National Standards Institute
 - 3. ISA – International Society of Arborists
 - 4. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.
 - 5. TPI – Turfgrass Producers International
- C. Owner: The Owner's authorized representative or authorized consultant.

1.3 QUALITY ASSURANCE

- A. The work of this Section shall be performed by a single firm experienced in landscape planting and holding a current California Contractor's A or C27 License.
- B. Tree and plant quality and sizes shall conform to the current edition of "American Standard for Nursery Stock" for Number One nursery stock as adopted by the American Nursery & Landscape Association (ANSI Z60.1). Plants shall be of uniform, standard size for their listed container size, neither overgrown and root bound or encircling, nor so recently transplanted that the root system is not thoroughly well established throughout the container. Roots should reach

the sides of the container and maintain a firm root ball. Pruning shall not be done prior to delivery except by prior approval.

- C. Trees shall also comply with quality characteristics described in "Guideline Specifications for Nursery Tree Quality" current edition, published by the Urban Tree Foundation. Trees not in compliance with any of the following characteristics may be subject to removal and replacement, whether planted or still in their containers.
 - 1. Acceptable caliper and height ranges for the Type, Form and Size of tree.
 - 2. An intact central leader, or after heading of an old leader, the new leader diameter is greater than one-half the diameter of the old leader. Co-dominant leaders are not acceptable.
 - 3. Scaffold branch diameters are less than two-thirds the diameter of the trunk, and without included bark at the attachment.
 - 4. Scaffold branches shall be balanced, well spaced vertically, and with a radially blank section no greater than one-third of the canopy circumference.
 - 5. Temporary branches on the lower trunk shall be less than three-eighths inch diameter, and the clear trunk height shall be no more than forty (40) percent of the overall tree height.
 - 6. The root collar and rootball shall be free of defects, including circling, kinked and girdling roots. Roots at the edge and bottom of the container shall be less than one-quarter inch diameter, and uniformly distributed throughout the container.
 - 7. The tree canopy width shall be a minimum of twenty-five percent of the standard form tree height, except for naturally columnar forms.
- D. Botanical names shall take precedence over common names. Provide plants that are true to name. Tag one representative plant of each species and size with the botanical name and size.
- E. Inspection:
 - 1. All landscape work and materials shall comply with applicable Federal, State, County and City regulations.
 - 2. All plant material shall be reviewed onsite by the Owner's Representative and/or Landscape Architect prior to positioning and planting. Review shall not limit the right of rejection during any stage of the work until Final Acceptance for any reason including condition of the foliage or root ball, size, variety, form, appearance, latent defects or injuries. Rejected plants shall be removed from the site and replaced immediately by the Contractor at no additional cost to the Owner.
- F. Qualifications of Workers
 - 1. Employ skilled workers who are thoroughly trained experienced in landscape planting and who are completely familiar with specified requirements and methods needed for proper performance of the work in this section.
 - 2. Provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.
 - 3. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation. Submit a copy of the Certificate.
- G. Any pruning of existing trees specified as part of this Work shall be performed under the direct supervision of an ISA Certified Arborist and in compliance with ANSI A300-Part 1 Standard Practices (Pruning).

1.4 SUBMITTALS

- A. In accordance with the Submittal section, submit:
 - 1. A complete materials list of all items proposed to be furnished including estimated quantities.

2. Laboratory analyses of soil conditioning materials shall have been performed within one year of the submittal date.
 3. Quality Certificates and/or Certificates of Inspection required by government agencies (providing duplicate copies for the Owner's Representative).
 4. Qualified Applicator Certificate, and DPR Registration Certificates and Material Safety Data Sheets for all pesticides/herbicides proposed for use.
 5. Submit photos with a scale marker of all boxed trees proposed for use from the nursery source. Photos shall clearly show the individual tree form without background greenery.
- B. Soil amendments: Submit one (1) pint sample and an analysis of organic compost and mulch.
- C. Other Samples: When requested by the Landscape Architect and/or Owner's Representative.
- D. Soil Fertility Analysis and Recommendations:
1. The Contractor shall provide and pay for a fertility analysis of the existing topsoil and any proposed import planting topsoil. After mass grading operations are completed, native soil samples shall be collected for the fertility analysis by collecting a minimum of 5 representative samples of the soil per acre throughout the area of work. Separate samples shall be produced for cut and fill areas, and for any other area composed of soils not similar to the existing soils. Each sample shall be a minimum of one pint each, and shall be thoroughly mixed together to prepare a homogenous sample. A one quart representative sample for cut, fill and any other special conditions shall be submitted to the soil testing laboratory as a representative sample for fertility analysis. The fertility analysis shall at a minimum provide the following data:
 - a. soil texture class and percent sands, silts and clays per ASTM D422
 - b. estimated soil infiltration and percolation rates
 - c. pH
 - d. organic matter (%)
 - e. total soluble salts (ECe)
 - f. Cation Exchange Capacity (CEC) and Percent Cation Saturation for K, Mg, Ca and Na
 - g. major and minor nutrients (ppm).
 2. Recommendations for improvement of the soil conditions for optimum plant growth shall be made by the testing laboratory, and at a minimum shall include the following:
 - a. A fertilizer and amendment application program (including macro and micro nutrients) for both pre-planting and maintenance fertility applications for broad area tillage and for planting pit backfill (pre-plant only).
 - b. Treatments to neutralize soil pH and to correct any adverse conditions as warranted.
 - c. Recommendations shall address soil conditioning for both planting area tillage and tree/plant planting pit backfill.
 3. The soil analysis and recommendations shall be performed by one of the following laboratories capable of providing the above analyses by a licensed soil scientist:
 - a. D&D Agricultural Laboratory. Contact Darrin Peters at 559-348-1818.
 - b. Wilber-Ellis Company. Contact Michael Cline at 209-442-1220.
 - c. Wallace Laboratory, Contact Garn Wallace at 800-GREEN99
 4. The Contractor shall submit the results of the soil testing investigations and shall receive written direction from the Landscape Architect before proceeding with any soil conditioning activities such as fertilizing and/or adding amendments.
- E. Within seven days from the start of the maintenance period, submit a calendar of maintenance activities, including scheduled dates for mowing, fertilizing, weed control and all other activities. Provide the quantities of maintenance fertilizer and any other materials scheduled to be used in each application during the maintenance period.

- F. Submit invoices and/or delivery tags from material suppliers for all amendments, fertilizer, seed, plants, mulch and any other materials provided for the landscape planting installation and applied during the maintenance period. Submit tags from seed packaging indicating seed varieties, percent purity and percent germination minimums. The invoices and/or delivery tags shall be provided directly to the Owner's Representative/Inspector of Record within 24 hours of delivery to the site, as well as to the normal submittal recipients per the Contract Documents.
- G. Close Out Documents: Submit prior to the start of the maintenance period, two bound copies of the following:
 - 1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of plant nurseries, materials and equipment vendors with names and addresses of the vendor/manufacturer representatives and warranty periods.
 - 2. A "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions.
 - 3. Maintenance Manuals and Instructions: Submit a monthly schedule of procedures to be established by Owner for maintenance of landscapes (trees, mixed planting and turfgrass) for one full year and shall include recommendations for fertilizing, pest and disease control, mowing, aeration and top dressing.
 - 4. Soil Amendment and Seed/Stolon Confirmation Form noting the installed quantities of materials and the person who confirmed the delivery and installation of the materials.
 - 5. Operations and Maintenance Manuals and Warranty certificates for any maintenance equipment turned over to the Owner.
 - 6. As-built Record Drawings with all modifications to the Drawings noted in red ink, and the Landscape Planting Observation Log completed.

1.5 AVAILABILITY

- A. The Contractor shall confirm availability of plants, supplies, and materials prior to submitting his landscape bid. Plant variety substitutions are not desired.
- B. If a plant is found not to be suitable or available, the Contractor is to notify Landscape Architect before bidding. The Landscape Architect is then required to select a reasonable alternate and to inform all those bidding of the availability of the original plant. If a substitute is selected it must be of the same size, value and quality as the original plant. Failure to inform the Landscape Architect of unavailable plants prior to bidding will require that all plants specified shall be provided by the Contractor at time of installation.
- C. Plant container size listed on construction documents are minimum acceptable size. If plant material specified is not substituted prior to award of the contract the minimum container size specified shall be provided by the Contractor. If the Contractor can not provide the minimum specified size plant material at the time of installation, the Contractor shall be required to install a larger size container of the plant specified at no additional cost to the Owner.

1.6 EXISTING CONDITIONS

- A. The Contractor is to visit the job site to verify existing conditions including soils, vegetative growth, subsurface conditions, existing grade and drainage, irrigation system etc. making allowances in his bid for any required work to provide the landscape installation as specified in the construction documents.
- B. The Contractor shall notify the Owner to locate underground lines prior to hole boring or trenching. Do not permit heavy equipment such as trucks, rollers, or tractors to damage utilities. Hand excavate as required to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.

Prevent damage to temporary risers of underground irrigation system and similar obstructing work located in the landscape areas.

- C. If there is a conflict with existing utilities, improvements and/or planting and the proposed planting, Contractor shall promptly notify the Owner's Representative for instructions as to further action. Failure to do so will make Contractor liable for any and all damage or corrective actions arising from his operations.
- D. Prior to the start of this work, the Contractor and the Owner's Representative shall verify the operational condition of that portion of the existing irrigation system pertaining to the proposed planting area. The Contractor shall notify the Owner's Representative of any repairs and/or corrections necessary for proper functioning and coverage. The repairs and/or corrections shall be completed before any plant material is planted. Failure to perform system verification and provide notification prior to the start of this work will make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage, as well as any required plant replacement, without any additional cost to the Owner.
- E. No plants shall be planted in situations that show poor drainage infiltration or low areas that result in standing water. Such situations shall be corrected by the Contractor as directed by the Landscape Architect or Civil Engineer. Failure by the Contractor to notify the Owner of poor drainage conditions prior to proceeding with the conditioning or planting operations shall place the responsibility for any plant removals, additional soil conditioning and replanting on the Contractor without any additional cost to the Owner. Any corrections of finish grading not in compliance with the Contract Documents including plant removal, soil conditioning and replanting shall be performed by the Contractor at no additional cost to the Owner.

1.7 PROTECTION

- A. The Contractor shall guarantee repair of damage to any part of the premises resulting from but not limited to leaks, defects in materials or workmanship, operation of equipment, storage of materials and/or equipment, installation of underground or overhead utilities. The Contractor shall be liable for any and all accidents resulting from his work, including open holes and trenches during construction.
- B. Protect new and existing landscape areas in the area of work from theft, loss, damage and deterioration during storage, installation and maintenance. Protect from unauthorized persons (trespassers) as well as from operations by other contractors and tradesmen, and landscape operations. Protect all planted turf and shrub areas from persons as well as operations of other contractors and the Owner. Cost of protection shall be born by the Contractor with means of protection such as temporary fencing as approved by Owner. Cost for protection shall be included in the Contractor's bid for the work.
- C. Contractor shall repair or replace damaged work and/or damage to existing improvements/landscape as identified by the Owner's Representative to a condition acceptable to the Owner's Representative. No additional payment will be made to the Contractor for repair or replacement of damaged work and/or damage to existing improvements/landscape.

1.8 OBSERVATIONS

- A. General:
 - 1. Installation and operations must be approved by the Owner.
 - 2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Owner. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.

3. In all cases, where inspection of the landscape planting work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner's Representative, the Contractor shall notify the Owner's Representative at least 48 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to have the required inspection, shall be performed at the Contractor's own expense.
- B. The Owner's Representative, Project Inspector or Landscape Architect shall perform periodic observations and shall record the observation on the Landscape Planting Observation Log form on the As Built Record Drawings. Observations made and noted in a Field Report are acceptable if included in the Close-out Documents. Such observations shall include but are not necessarily be limited to:
 1. Weed control operations prior to other portions of work.
 2. Ripping and soil conditioning of the planting area.
 3. Layout of the plant material and trees at the site prior to planting in order to avoid conflicts and to meet the design intent.
 4. Condition and quality of plant material prior to planting.
 5. Auguring, digging and preparation of plant pits and drainage sumps for trees and shrubs.
 6. Planting and staking of trees.
 7. Planting of shrubs, ground cover and turfgrass.
- C. Any corrective action called for shall be immediately performed by the Contractor.
- D. Failure by the Contractor to obtain the above observations shall place the responsibility on the Contractor for any relocation and/or replacement of planted trees or shrubs.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Plant label shall identify each species and variety. A label shall be attached to each individual plant or block of identical plants grouped together.
- B. Adequately protect plants from sun and wind prior to planting. Do not allow stored plant material to dry out at any time.
- C. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site. Store materials and equipment in a location as directed by the Owner's Representative.

1.10 PESTICIDE NOTIFICATION

- A. A written notification of any and all pesticide/herbicide products scheduled for use by the Contractor or their representative on the Owner's property must be submitted to the Owner's Representative at least seven days prior to the scheduled application. Notification shall include the product name, manufacturer's name, the pesticide active ingredient, the U.S. EPA and CalDPR registration numbers, the scheduled date and application areas, and the reason (target species) for the application.

1.11 REPAIR OF DAMAGED EXISTING PLANTING AREAS

- A. The Contractor shall be responsible to repair all damage and/or distress to existing planting areas including turfgrass, shrubs, ground covers, perennials, etc., whether specifically shown on the Contract Documents or not, as a result of construction operations, material and/or equipment storage, site access, site offices, utility and/or irrigation line installations or other actions.

- B. Replacement shrubs shall be 15 gallon size, replacement ground cover and perennial plants shall be 5 gallon size, and turfgrass shall be full width sod. Damaged areas shall be amended and finish graded per the Contract Documents prior to planting. Non-turfgrass planting areas shall also receive wood mulch as specified herein. The limits of repair shall be determined by the Owner.

1.12 SEASONAL REQUIREMENTS FOR TURFGRASS SEED / STOLON PLANTING

- A. Warm-season turfgrass seed /stolon planting shall be performed between May 1 and August 1. Any turfgrass seed application outside of the above period shall be an approved cool-season turfgrass variety, blend or mix and shall be temporary until the permanent warm-season turfgrass can be planted.
- B. Contractor may at his own risk plant warm-season turfgrass seed/stolons after August 1. However, if the warm-season turfgrass does not adequately germinate and develop into a full stand of grass within forty-five (45) days to the satisfaction of the Owner and Landscape Architect, the Contractor shall be responsible for overseeding with an approved cool-season turfgrass, and shall also maintain the cool-season turfgrass and reinstall the warm-season turfgrass after May 1 of the following year per Subsection C below at no additional expense to the Owner.
- C. If a warm-season turfgrass is originally specified but a cool-season variety, blend or mix is temporarily installed outside of the above planting period, the Contractor shall perform the following work at no additional expense to the Owner.
 - 1. Maintain the temporary cool-season turfgrass for ninety (90) days per Subsection 3.16.
 - 2. Return to the project site during the warm-season planting period, and provide worker sanitary facilities if not available.
 - 3. Prepare topsoil samples and provide a soil fertility analysis as described in 1.05, E.
 - 4. Perform two cycles of herbicide removal of the cool-season turfgrass, and remove the resulting organic debris.
 - 5. Aerate the topsoil with slicing tines to a minimum depth of six (6) inches. Make a minimum of two passes, each in a perpendicular direction.
 - 6. Apply fertilizer and conditioners to the topsoil as recommended by the soil analysis and approved by the Landscape Architect.
 - 7. Finish grade and prepare topsoil for seed / stolons.
 - 8. Apply the warm-season turfgrass seed / stolons at specified rates per Subsection 3.12.
 - 9. Maintain the newly established warm-season turfgrass for ninety (90) days per Subsection 3.16.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Topsoil used in planting areas shall be a clean, friable soil with no noxious weeds, clods or stones larger than 0.5 inch in diameter, subsoil, hardpan, wood, debris, fine organic material greater than 5%, undesirable insects, plant disease or any other natural or extraneous objects detrimental to normal plant growth to a minimum depth of 18 inches from finish grade.
- B. The Contractor shall provide a particle size analysis, fertility testing and amendment recommendations of proposed native and/or import topsoil, and the Landscape Architect reserves the right to reject topsoil not conforming to the minimum specifications. Stockpiled onsite topsoil may be used if analysis and testing determines compliance with these requirements prior to placement. Failure to meet minimum specifications shall result in the removal of any unauthorized placed topsoil at the Contractors expense.

- C. Particle size distribution for topsoil shall meet the following per ASTM D422:
1. 100% passing a 12.2 mm (1/2") screen.
 2. Minimum 95% passing a 9.5 mm (3/8") screen.
 3. Minimum 75% passing a 2.36 mm (No. 8) screen.
 4. Maximum 45% passing a No. 200 screen.
 5. Silt content shall be a maximum 35%.
 6. Clay content shall be a maximum 25%.
 7. Silt to Clay ratio shall be less than 2 and greater than 0.5.
- D. Other characteristics shall conform to the following:
1. Permeability rate shall be not less than one (1.0) inch per hour or not more than 20 inches per hour.
 2. The sodium absorption ratio (SAR) shall not exceed 3.0 and the electrical conductivity (ECe) shall not exceed 2.5 milliohms per centimeter at 25 degrees centigrade.
 3. Soluble boron shall be no greater than 1.0 part per million (mg/l).
 4. Soil pH range shall be 6.5 – 7.9.
 5. Maximum concentration of soluble chloride shall be 150 parts per million.
 6. Maximum concentration of heavy metals shall not exceed the following when the pH is between 6 and 7:
 - a. Arsenic: 0.5 ppm
 - b. Cadmium: 0.5 ppm
 - c. Chromium: 5 ppm
 - d. Cobalt: 1 ppm
 - e. Lead: 15 ppm
 - f. Mercury: 0.5 ppm
 - g. Nickel: 2.5 ppm
 - h. Selenium: 1.5 ppm
 - i. Silver: 0.25 ppm
 - j. Vanadium: 1.5 ppm
 7. Petroleum hydrocarbons shall not exceed 100 mg/kg dry soil.
 8. Aromatic volatile organic hydrocarbons shall not exceed 2 mg/kg dry soil.

2.2 SOIL AMENDMENTS

- A. Organic Compost: "Harvest Premium" as supplied by Harvest Power (559) 435-1114; "WonderGrow Compost" by Grover, Inc. (866) 764-5765, or "Allgro Compost" by Synagro (559) 341-5158, or approved equal and conforming to the following minimums per the US Composting Council 'Compost Technical Data Sheet' report dated within three months of the submittal date:
1. Certified as "Mature" or better
 2. Pass EPA Class A standards for pathogens and heavy metals.
 3. Particle size: 1/8" maximum
 4. pH: 6.0-7.5.
 5. Macro-nutrients: Minimum of 1.0% Nitrogen, 0.5% Phosphorus, 0.5% Potassium.
 6. AgIndex ratio (Nutrients/Salts) 10 or more.
 7. Ammonia N/Nitrate N ratio: rated Mature or Very Mature
 8. Organic matter content greater than 50% dry weight.
 9. Ash: equal or greater than 6%, not greater than 20%
 10. Carbon/Nitrogen ratio: less than or equal to 25.
 11. Salinity (ECe): less than 10.0 dS/m.
 12. Odor shall be soil-like (musty, earthy) without any sour, ammonia-like or putrid smell.
- B. Gypsum shall be mined agricultural grade gypsum composed of no less than 100% CaSO₄-2H₂O hydrated calcium sulfate in a pelletized form. Elemental Sulfur shall be a minimum 95% pure agricultural grade.

- C. Dry Humate organic soil conditioner comprised of 70% humic acid from Leonardite.
- D. Endo 120 Mycorrhizae containing a minimum 60,000 living propagules per pound.
- E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

2.3 FERTILIZER

- A. Trees and Shrubs: Fertilizer for all trees and shrubs to be BEST PAKS (20 10 5) controlled release fertilizer in a biodegradable 10 gram packet. The BEST PAKS shall be applied at the following rates:
 - 1. 1 Gallon Can: 1 Best-Pak
 - 2. 2 Gallon Can: 2 Best-Paks
 - 3. 5 Gallon Can: 5 Best-Paks
 - 4. 15 Gallon Can: 10 Best-Paks
 - 5. 24" Box: 16 Best-Paks
 - 6. 36" Box: 24 Best-Paks
- B. The pre-plant fertilizer shall be a commercial homogeneous, granular pellet:
 - 1. Pre-plant fertilizer for turfgrass shall be:
 - a. BEST 6-24-24-5S XB+ with Avail
 - 2. Pre-plant fertilizer for mixed plantings shall be:
 - a. BEST Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.
- C. The maintenance fertilizer shall be a commercial homogeneous, granular pellet:
 - 1. Maintenance fertilizer for turfgrass shall be one or more of the following:
 - a. Urea 46-0-0
 - b. BEST Ammonia Sulfate 21-0-0-24S, standard grade, or equal
 - c. BEST Nitra King 21-2-4-14S-2Fe, or equal.
 - d. BEST Nitex 20-2-3-12S-5Fe, or equal.
 - e. Best Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.
 - 2. Maintenance fertilizer for mixed plantings shall be the pre-planting fertilizer.
- D. Fertilizer material types and analysis may be subject to change based on the findings and recommendations from the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount. Allow for at least three separate fertilizer applications in any one application session of pre-plant and/or maintenance fertilizers.

2.4 MULCH

- A. Mulch for on-grade or raised native soil planters shall be a walk-on type of chipped and aged greenwaste woody material without leaves, green wood, sticks, dirt, stones, dust and other non-organic debris as accepted by the Landscape Architect. Particle size 1/2" to 3" in general size.

2.5 STAKING & GUYING MATERIALS

- A. Stakes: 2" Diameter lodgepole pine, pressure treated and pointed one end.
- B. Ties: V.I.T. Cinch Tie, 32 inches long, V.I.T. Products, Inc. (619) 673-1760, or equivalent.
- C. Add guys and deadman anchors for trees over 24" box size.

2.6 PLANTS

- A. Plants shall be typical of their species and variety, shall have normal growth habits, well developed branches and be densely foliated, and shall have fibrous root systems. No substitutions will be allowed unless approved in writing by the Landscape Architect.
- B. Plants shall be free from defects and injuries including disease, insects, insect eggs and larvae and girdled or matted roots.
- C. Quality and size of plants shall be in accordance with ANSI Z60.1-2004, "American Standard for Nursery Stock", and as described in Quality Assurance.
- D. Plants shall not be pruned before planting.
- E. Plant material must be selected from nurseries that have been inspected by State or Federal Agencies.
- F. Plants shall be nursery grown and shall have been transplanted or root pruned at least once in the past three (3) years. Plants shall have been grown under climatic conditions similar to those in the locality of the project.
- G. Each bundle of plants shall be properly identified by weatherproof labels securely attached thereto before delivery to the project site. Label shall identify plant by name.
- H. Nomenclature shall be in accordance with Sunset Western Garden Book, current edition.
- I. No plants shall be removed from their container until a review has been made in the field or at the nursery, or except when specifically authorized in writing by the Owner.
- J. Collected plant material may be used only when approved. Approval shall not limit the right of rejection during work progress for conditions of the root ball, latent defects or injuries.
- K. Where shown a "MULTI" provide trees with a minimum of three trunks.
- L. Plant sizes listed on the planting plan are minimum acceptable sizes. The quantities listed are the Landscape Architect's estimate only. The Contractor is responsible for the quantities of plant symbols shown on the plan, and/or the quantities in hatched planting areas at the specified triangular spacing.

2.7 TURFGRASS SOD

- A. Sod shall be produced from certified or approved seed/stolons, fresh and labeled in accordance with U. S. Department of Agriculture Rules and Regulations. Sod quality shall be Premium or Standard Grade per TPI specifications.
- B. Sod shall be neatly mowed and be mature enough that when grasped at one end it can be picked up and handled without damage, delivered to the project site, adequately protected and installation commenced within 24 hours of harvesting.
- C. Turfgrass shall be a species and variety as specified in the Contract Drawings. If a warm-season grass is specified and the installation is to be performed between the months of October and April, a species with an established perennial ryegrass overseeding shall be installed. Submit the overseeded product information for approval prior to the installation.

2.8 TURFGRASS SEED

- A. Seed shall be delivered in original unopened containers with legible identification labels. Store in a shaded and dry location protected from weather or damage.
- B. Seed shall be from a Certified source, hulled and coated, and shall be a species and variety as specified in the Contract Drawings.
- C. Warm-season Bermudagrass seed shall be a one of the following improved blends:
 - 1. "La Prima" by Seed Research of Oregon. Available from Horizon in Fresno (559) 431-8007.
 - 2. "Bermuda Triangle" by Pennington Seed. Available from Wilber-Ellis (916) 991-4451; or Western Farm Service (559) 686-3375.
- D. Cool-season turfgrass for temporary seeding or overseeding shall be a blend of annual and perennial ryegrass, "SOS 211" by Barenbrug USA or equal. Available from Valley Seed (559) 225-7333.

2.9 ROOT BARRIER

- A. A ribbed polyethylene panel of minimum 0.080" thickness equal to Deep Root Partners #UB 24-2 PANEL, (800) 458-7668.

2.10 TREE TRUNK PROTECTOR

- A. A. ArborGard+ polyethylene tree guard by Dimex (800) 334-3776, or equal.

2.11 HERBICIDES

- A. Herbicide products for removal of unwanted grass and broad-leafed weeds shall be registered and approved for use by the U.S. EPA and CalDPR, and shall comply with the Owner's Standards and with the "Healthy Schools Act" with current amendments. , and with the current list of prohibited herbicides at Schools and Child Care facilities per California Assembly Bill 405.
- B. Provide pre-emergent and post-emergent, selective herbicide formulations for use on turfgrass areas and/or ornamental shrub/ground cover areas that are not injurious to the proposed plantings and turfgrasses.
- C. Provide a non-selective contact herbicide formulation only for use to remove existing established weeds prior to new plantings. The herbicide shall be certified for organic use, broad-spectrum with systemic function, 'Weed Slayer' by Agro Research International, or equal.

2.12 OTHER MATERIALS

- A. Materials not specifically indicated, but necessary for proper execution of the work, shall be of first quality as selected by the Contractor subject to approval of the Landscape Architect.

PART 3 - EXECUTION

3.1 EXAMINATION & PREPARATION

- A. General: Verify that existing site conditions are as specified and indicated before beginning this work.

- B. Damaged Earth: Verify that earth rendered unfit to receive planting due to concrete water, mortar, limewater, hydrocarbons or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Owner's Representative.
- C. Examine the area and conditions under which the work in this section is to be performed. Verify that any existing irrigation system within the limit of work is in proper working order with full coverage. Correct conditions detrimental to the timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of the work signifies acceptance of the existing conditions.
- D. Protection:
 - 1. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment within the area of work prior to commencing work.
 - 2. Mark existing irrigation heads, valves, valve boxes and other below grade equipment or components that are scheduled to remain. Protect in place.
- E. Runoff and Erosion Control: Furnish equipment, materials and labor necessary to control the flow, drainage, and accumulation of excess water running off the work area and prevent soil erosion, blowing soil and accumulation of wind deposited material on the site per the approved SWPPP.

3.2 ROUGH GRADING, SOIL PREPARATION, PLANTER BACKFILL

- A. Rough grading shall be performed by other subcontractors to the extent of establishing rough pads, slopes and drainage patterns. The Contractor is responsible for placement of topsoil and grading required to ensure positive drainage in all turfgrass and planting areas. All planting areas shall have a minimum topsoil depth of 18 inches from on-site native and/or approved import sources. Rough grading shall be completed prior to weed control, cross ripping or rock removal operations.
- B. After the completion and acceptance of the weed control operations outlined below, and unless directed otherwise by the Landscape Architect or noted on the Drawings, and except for the area under the canopy of existing trees, the Contractor shall cross rip and till (break up large clumps and clods in excess of 2 inch diameter) the existing soil within all planting areas outside the canopy drip line of existing trees until the soil is loose and friable. Ripping shall be to a minimum depth of twelve inches (12") in turfgrass areas and eighteen inches (18") in shrub/ground cover areas, with ripping tines a maximum 18" apart performed in a minimum of four passes total in different directions (perpendicular and diagonal). The Contractor shall review the completed ripping operation with the Owner's Representative and Landscape Architect to determine compliance. The first 6 inches of any new topsoil fill shall be tilled into the existing soil to a minimum depth of 6 inches prior to placing any further topsoil fill. The Contractor shall provide any additional work as directed by the Owner's Representative after the review to obtain compliance. Do not proceed with the addition of topsoil and/or amendments, or commence rock picking or fine grading until the completed ripping operation is accepted in writing by the Owner's Representative.
- C. Planting area soil under the canopy drip line of existing trees, or in planting beds not accessible by motorized equipment, shall be ripped to a minimum depth of 12 inches using manual spading shovels, forks and/or broadforks and working around major tree roots and/or utilities. In areas receiving new mulch, rip to a minimum depth of 4 inches while protecting any existing plants and their root system. Break up and/or remove rocks and clods as indicated below.
- D. Do not work soil when moisture content is so great that excessive compaction will occur, or when it is so dry that dust will form in air or clods will not break up readily, or when a full ripping depth cannot be achieved. Apply water, if necessary, to bring soil to an optimum moisture

content for tilling and dust control. Maintain within 2 percent above or below optimum moisture content for the existing soil type at all times during the work.

- E. After soil ripping and preliminary finish grading is completed, the topsoil in open ground shall be cleared of all concrete, wire, sticks, roots, debris and foreign materials. Remove native stones and clods as follows:
 - 1. In shrub/ground cover areas, remove stones and clods greater than one (1.0) inches in diameter from the top 3 inches of finish grade.
 - 2. In general, non-traffic turfgrass areas, remove stones and clods greater than three-quarter (0.75) inch in diameter from the top 3 inches of finish grade.
- F. Add clean planting topsoil where needed to bring grade to elevation to promote positive drainage. Spread approved planting topsoil over ripped subgrade prior to incorporating amendments.
- G. Backfill all raised grade planters with a minimum depth of 18 inches of imported clean sandy loam planting topsoil conforming to Subsection 2.02 and approved prior to import and/or placement. Failure to obtain import approval prior to backfilling raised grade planters shall result in the removal of any planting and non-approved backfill, and the reinstallation of the work with approved materials.

3.3 WEED CONTROL

- A. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation.
- B. The Contractor shall treat any weeds in proposed new turfgrass and planting areas with a post-emergent contact weed killer at manufacturer's approved rates prior to any commencement of work at the site including any irrigation work, ripping of soils or fine grading. Areas planned for turfgrass seed/stolon planting shall in addition receive "grow and kill" weed removal as outlined below.
- C. Weed eradication shall be ongoing throughout the course of the landscape installation. The Contractor shall apply a pre-emergent herbicide after shrub/ground cover planting and prior to mulch installation. Manually remove weed seed heads. At no time will weeds be allowed to become established. Contractor shall provide all weed control operations as directed by the Owner's Representative.
- D. All weed control operations using pesticides/herbicides shall comply with the CalDPR and Owner Standards as well as AB2260 "Healthy Schools Act". The Contractor shall comply with the notification and posting requirements of the "Healthy Schools Act".
 - 1. The Contractor shall notify the Owner per Subsection 1.11, A.
 - 2. The Contractor shall post highly visible signs around the treatment area in conformance with the "Healthy Schools Act" warning of a scheduled pesticide/herbicide application a minimum of 24 hours before to 72 hours after a pesticide application.
- E. A non-selective contact herbicide for grassy weeds in hardscape areas only shall be '20% Vinegar Weed Slayer' by Good Natured, CA DPR Reg# 85208-1-AA-42177, shall be applied directly to the weed foliage. Only apply to dry surfaces, and a minimum of 8 hours before a rain event. Allow a minimum of 14 days from herbicide application to commence any planting.
- F. Perform pre-plant clearing and weed control for native open ground areas planned to receive turfgrass as follows:
 - 1. Apply irrigation to encourage weed growth prior to ripping, and to maintain moisture in the soil.

2. Apply a contact herbicide to weed foliage. Remove weeds and expose bare soil.
 3. Lightly disk/till to a depth of three-inches.
 4. Perform a "grow and kill" operation after the first disking/tillage:
 - a. Water and lightly fertilize to encourage weed germination.
 - b. Follow with a second application of a contact herbicide.
 - c. Remove weeds and perform a light harrowing or disking.
 5. Apply irrigation to encourage weed growth. If additional weeds germinate, perform a second "grow and kill" operation.
 6. Once existing weeds are completely removed, obtain authorization from the Owner's Representative to proceed with deep ripping, rock removal, soil conditioning and finish grading operations. Allow a minimum of 14 days from herbicide application to commence any planting
- G. Just prior to turfgrass installation, and/or after the shrub/ground cover planting is complete and prior to mulch installation, apply an approved pre-emergent herbicide per the manufacturer's recommended rates.

3.4 SOIL CONDITIONING

- A. Before commencement of any soil conditioning, weed and rock removal shall be completed as outlined above.
- B. Uniformly amend the entire area of topsoil in turfgrass and mixed planting areas per the following bid rates and per the approved modifications as a result of the soils analysis recommendations:
1. Turf and Non-Sloped (less than 4h:1v) Planting Area Soil Conditioning (per 1,000 square feet).
 - a. Compost at a rate of six (6.0) cubic yards (a 2.0 inch thick layer).
 - b. Gypsum at a rate of 100 pounds, or Sulfur at 19 pounds, or an equivalent combination.
 - c. Humate soil conditioner at a rate of thirty (30) pounds.
 - d. A pre-planting fertilizer to turfgrass areas at a rate of 1.25 pounds of actual P and K.
 - e. A pre-planting fertilizer to mixed planting areas at a rate of 1.5 pound of actual N.
 - f. Mycorrhizae per Subsection 3.06, Mycorrhizae Application.
- C. Till soil amendments into the entire planting area soil to a minimum depth of six (6) inches. Perform the cultivation in at least two passes, one in each perpendicular directions to the first, so that the amendments are homogeneously incorporated into the topsoil. All cultivation inside the dripline of existing trees shall be preformed manually with minimal disturbance to the root system.
- D. Planting backfill for trees and shrubs shall be a mix of three parts native soil and one part Compost by volume. Add Humate at 2.0 pounds, and Mycorrhizae at 0.5 pounds.
- E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

3.5 FINE GRADING

- A. Upon completion of soil preparation, fine grade all planting and turfgrass areas to a smooth and even slope conforming to and establishing drainage patterns per the approved Grading Plan. Grading shall eliminate all humps and hollows and promote positive drainage in all planting and turfgrass areas.

- B. Where hardscape is installed in existing planting areas, a minimum transition grade width of 2 feet adjacent to the edge of hardscape shall be constructed unless noted otherwise. The maximum slope of any transition grade shall be 20 percent. The area of transition grading shall be planted or repaired as specified herein.
- C. Tolerance of grade differential for planting and general turfgrass areas shall be plus or minus 0.04 foot. If requested, the Contractor shall water test all turf and planting areas after the grading operations are completed in the presence of the Owner's Representative and Landscape Architect. The water test shall consist of applying water to the turf and planting areas to the point where water begins to run over the soil to show the drainage pattern. Make all corrections to the finish grading as required by the Owner's Representative to re-established positive drainage patterns. Acceptance of the finish grading shall be obtained in writing from the Owner's Representative and Landscape Architect prior to proceeding with soil conditioning and planting operations.
- D. Turfgrass sports fields shall be fine graded using a laser controlled machine capable of producing final grades within 0.02 foot plus or minus from the proposed elevations.
- E. After the finish grading process, relative compaction of the soil in turf and planting areas shall range between 82% and 85% relative density. Compaction/moisture levels are generally acceptable if an Oakfield probe is able to penetrate a minimum of six inches into the cultivated planting topsoil with moderate pressure. The Owner reserves the right to require the Contractor to test for over compaction. If the compaction is within the acceptable range, the test will be paid for by the Owner. All testing due to non-compliance will be paid for by the Contractor.
- F. Remove all rocks produced as a result of the soil conditioning and finish grading operations per the requirements of Subsection 3.2.
- G. Finish grades shall be one-half inch (1/2") to three-quarter inch (3/4") for turfgrass sod areas, flush (0.0") for turfgrass seed/stolon areas and two inches (2") for shrub/ground cover planting areas below the finish surface of all adjacent walks, curbs, mowstrips and utility/valve boxes or collars. Transition any grade modification in existing planted areas at a maximum 12h:1v slope to existing grade, unless shown otherwise on the grading plan.

3.6 MYCORRHIZAE APPLICATION

- A. In turfgrass planting areas, after fine grading is completed broadcast Endo 120 Mycorrhizae at a rate of one and one half (1.5) pounds per 1,000 square feet (65 lbs. per acre). Lightly rake into the top one inch (1") of topsoil immediately prior to turfgrass installation.
- B. In shrub and/or ground cover planting areas, the Mycorrhizae inoculant shall be incorporated into the soil with the other soil amendments at three (3.0) pounds per 1,000 square feet (130 lbs. per acre) per Subsection 3.04, Soil Conditioning. Inoculant shall also be incorporated into the planting backfill per Subsection 3.4, E.

3.7 PLANTING

- A. General Requirements
 - 1. Obtain written approval from the Landscape Architect or Owner's Representative to begin planting operations. The irrigation system shall be fully automated and operational, all weeding, soil conditioning and finish grading completed, and the tree and plant layout approved.
 - 2. Planting shall be performed by workmen familiar with planting procedures and under the supervision of a qualified foreman. The planting foreman shall be on the job site at all times when planting is in progress.

3. Planting operations shall not occur under unfavorable weather conditions.
4. Boxed trees shall be planted first. Shrub planting shall be completed before groundcover is planted.
5. Proceed and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of planting required.
6. Cooperate with other contractors and trades working in and adjacent to the planting work areas. Examine drawings which show the development of the entire site and become familiar with the scope of other work required.

B. Planting Preparation and Operations

1. Planting material shall be provided with adequate protection of root system and balls from drying winds and sun. Do not bend or bind trees or shrubs in such a manner as to damage bark, break or destroy natural shape. Provide protective covering during delivery.
2. Deliver trees and shrubs after preparations for planting have been completed, and plant immediately. If planting is delayed more than six (6) hours after deliver, set trees and shrubs in shade, protect from weather and mechanical damage and keep roots moist. Do not remove container grown stock from containers until planting time.
3. All planting areas shall be smooth and even. Finish grades shall be done prior to any placement of plants.
4. Place all trees and shrubs in locations shown on the planting plan and obtain written field approval of the Landscape Architect before planting or digging planting pits. Inform the Landscape Architect seven (7) days prior to placing the plants. Maintain a minimum 15 foot clearance from trees to any light pole, unless specifically noted otherwise.
5. Carefully remove all canned stock from containers with tin snips or approved cutter. Cut away and remove any girdled or matted roots.
6. Excavate holes of circular outline with vertical sides for all plants 15 gallon or less. Boxed trees shall have square planting holes. The vertical sides and bottom of the holes shall be thoroughly scarified to promote union of backfill with existing soils. All trees shall have two drainage sump holes drilled with a twelve inch (12") diameter auger penetrating hardpan layers to a minimum one (1) foot into a sand/gravel layer or to a minimum depth of ten (10) feet below the planting pit bottom. Precautions shall be exercised to avoid smooth sides on the holes. Offset augured holes a minimum of eighteen inches (18") from planned tree location to avoid settling of tree after planting.
7. After cleaning out the sump holes, the Contractor shall test the sumps for drainage by flooding with water. If the water does not drain out within twenty-four (24) hours, auger down as required to achieve such drainage by breaking through the hardpan layer, or by extending the drainage sumps to a minimum depth of 15 feet below the bottom of the planting pit. After obtaining approval of the sump holes, fill the augured drainage sump holes with coarse concrete sand.
8. Tree and shrub planting pits shall be at least two and one half (2.5) times the width of the plant container, but a minimum of 36" wide for trees and 18" wide for container shrubs. Planting pits shall be as deep as the soil depth in the container or box, less the additional height of the crown above the finish grade. Specimen trees may have planting pits a minimum of two times the box size.
9. Set each plant in the center of the pit, plumb and straight. Set the crown of the plant at one inch (1") for shrubs, two inches (2") for trees above finish grade. When 1/2 of the backfill mix has been placed, tamp-in, insert fertilizer (BEST PAKS as per Section 2.1B1) and allow no air pockets as remainder of backfill is added.
10. Compact soil around the rootball of all plants and thoroughly water in the entire backfill depth.
11. Excess soil from plant holes shall be cultivated and raked to a smooth outline.
12. Shrubs and groundcovers shall be installed in relation to walks and paving to allow for future growth without obstructing traffic with clearance as shown on the drawings.

13. All plants shall be set in watering basin which shall be as wide as the planting pit, but at least four feet (4') in diameter and four inches (4") deep for trees and two feet (2') in diameter and three inches (3") deep for shrubs and vines.
 14. Ground cover plants shall be planted at the spacing noted on the drawings. Not more than fifteen minutes shall elapse from the time any groundcover plant is planted until it is watered.
- C. Pruning: Prune plants in accordance with established horticultural practice. Shearing of any plants will not be acceptable. Tree pruning shall only be performed with the written approval of the Landscape Architect and under the direction of a certified arborist, and shall comply with ISA Pruning Standards (ANSI 300).

3.8 MULCH

- A. Prior to any mulch application, perform weed control operations as specified herein.
- B. Where mulch is to be installed in an existing planting area, breakup/till the existing soil in open areas around existing plantings to a minimum 4" depth per section 3.2, and adjust finish grade adjacent to hardscape elements per section 3.5 where not prohibited by existing plantings.
- C. Install a minimum 3" layer of mulch in all non-turf planting areas, except for slopes greater than 3h:1v and seeded areas. Install a minimum 2" layer of mulch in all areas receiving flatted plants.
- D. Install a minimum 3" layer of wood mulch at a minimum 3' radius from the tree trunk of all trees located in turfgrass areas. Provide a smooth finish grade transition to a 2 inch depth where the mulch meets the turfgrass, so that the top elevation of the mulch is flush to the turfgrass soil. Keep mulch off the trunk. For new trees in turfgrass areas, remove the watering berm just prior to the turfgrass planting but maintain the mulched area within the planting pit.

3.9 STAKING & GUYING

- A. Trees shall be supported by two (2) tree stakes as shown on the drawings. Cut off the top of stakes damaged by installation or where the stake conflicts with canopy branches.
- B. Stakes shall be set firmly in the ground outside the rootball and where possible set stakes perpendicular to the prevailing northwest wind.
- C. Trees shall be tied to upright stakes loosely with tree ties (see planting detail). Remove the nursery stake.
- D. Multi-trunked trees shall be guyed, or individual branches may be staked and loosely tied as shown on the Drawings.

3.10 ROOT BARRIER

- A. Install root barrier along hardscape edges whenever the distance from the center of the trunk to the hardscape edge is less than eight (8) feet. Install per the planting details and manufacturers recommendations.

3.11 ARBOR GUARD

- A. Install ArborGard+ on all newly planted tree trunks in turfgrass areas per manufacturer's recommendations.

3.12 TURFGRASS SOD

- A. The area to be planted shall be finish graded to present a smooth and even surface free of humps and hollows and conforming to the finish grading plans. Where new sod is abutting existing turfgrass, fine grade to allow for the thickness of the new sod soil so that the new and existing sod grades are flush. Immediately prior to planting, the surface of the area to be planted shall be sufficiently loose and friable, with adequate moisture to receive the sod. Avoid laying sod on hot or dry soil.
- B. Lay first strip of sod slabs along a straight line (use a string in irregular areas). Butt joints tightly. Do not overlap edges. On second strip, stagger head joints (similar to a running bond brick pattern). Use a sharp knife to cut sod in order to fit curves, edges, and sprinkler heads.
- C. Install with turf-tired machinery full width sections **big roll** sod as delivered and flush to adjacent surfaces. Terminating sod edges shall be straight and at right angles to hardscape elements whenever possible.
- D. As the sod is being installed, water the sod lightly to prevent drying out. Continue to lay sod and lightly water until installation is complete.
- E. After laying sod, roll to eliminate irregularities and to form good contact between sod and soil. Avoid a too heavy roller or excessive initial watering which may cause roller marks.
- F. Water the completed lawn surface thoroughly. Topsoil should be constantly moist for a minimum two inches deep. Repeat irrigating at regular intervals to keep sod moist until rooted. The areas shall not be watered to the extent of saturating the soil and causing "flotation" or "flowing" of the top surface of the soil. After water has once been applied, no portion of the planted areas shall be allowed to dry out during the entire maintenance period. After sod roots are established, decrease frequency and increase amount of water per application as necessary to maintain good soil moisture to a minimum 6" depth without standing water or excess runoff. The Contractor shall be responsible to monitor the site and alter the watering times and frequencies to meet site and climatic conditions.
- G. Prior to the start of the maintenance period, fill all seam joint gaps greater than 1/8 inch and less than 0.5 inch with washed concrete sand. Fill any joint gaps of 0.5 inch or greater width with a minimum two foot long replacement sod section in order to achieve a tight joint.
- H. Replace dead or distressed sod with equivalent material as directed by the Landscape Architect.
- I. Do not install turfgrass inside the watering basin of new trees planted in turf areas, or within a 3' radius of existing tree trunks located in turf areas.

3.13 TURFGRASS SEED

- A. Complete soil conditioning operations and irrigation system installation prior to seeding. At the time of seeding, the surface of all areas to be seeded shall be free of large stones, sticks, stumps, or other deleterious matter one inch in diameter or larger, and shall be free from all wire, plaster, construction debris of any kind, or similar objects that would be a hindrance to seeding or maintenance.
- B. Maintain adequate soil moisture for seed germination and establishment. Use the cycling (multiple start) feature of the irrigation controller to prevent run-off.

- C. Warm-season turfgrass seed shall be planted at not less than 1/8 inch and no more than 1/4 inch depth at 4.0 pounds per 1,000 sq. feet.
- D. Warm-season turfgrass seed may only be planted when minimum soil temperatures are above 65 degrees F throughout the germination period.
- E. Cool-season turfgrass seed shall be planted at not less than 1/4 inch and no more than 1/2 inch depth at 9.0 pounds per 1,000 sq. feet (3.0 lbs/ 1,000 sq. ft. in each of three directions, the second and third perpendicular and diagonal to the first).
- F. Cool-season turfgrass seed may only be planted when soil temperatures are above 55 degrees F and below 85 degrees F throughout the germination period.
- G. Seed shall be applied by drill seeding only. If drill seeding, apply one-half of the total quantity of seed required in two different applications in perpendicular directions, e.g. north-south, and east-west.
- H. Protect the seeded area from disturbance (including erosion) and pedestrian traffic with barriers acceptable to the Owner. The Contractor is responsible to repair and reseed any disturbed or damaged areas.
- I. Reseed bare areas failing to adequately germinate a uniform density of plants within 14 days after the scheduled germination. The Landscape Architect shall be the sole judge of adequate uniformity and density. The Contractor shall reseed and/or correct any deficiencies until the acceptance of the seeded area by the Landscape Architect and Owner's Representative.
- J. Do not install turfgrass seed inside the watering basin of new trees planted in turf areas, or within a 3' radius of existing tree trunks located in turf areas.

3.14 CLEAN-UP AND REPAIR

- A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to existing planting and structures. Disturbed and/or damaged areas, whether a part of this work or from the work of other trades, shall be restored to their original condition.
- B. Plants and/or turfgrass shown to remain and damaged or removed by construction operations and/or utility/electrical/drainage lines shall be replaced with plants that match as closely as possible to the existing plant species, variety and size. The replacement turfgrass sod variety shall be the same as shown in the Planting Legend if for new work, or shall match the existing turfgrass variety where the turfgrass is existing. Adjust the finish grade so that the new turfgrass sod abuts flush to the existing turfgrass or to hardscape. The replacement plants and/or turfgrass sod shall be maintained as part of the original scope of work.
- C. After the planting operations are completed, the Contractor shall remove all trash, excess soil, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired at the Contractor's expense and the site shall be left in a neat and orderly condition to the satisfaction of the Owner.

3.15 PRE-MAINTENANCE REVIEW

- A. A general review will be held prior to the start of the maintenance period upon conclusion of the planting operations, irrigation system installation and after clean-up has occurred. The Owner's Representative shall be informed in writing a minimum of seven (7) working days prior to the time the work is ready for review in order to arrange a suitable time and date for such review.

- B. At the time of review, Contractor shall have all planting areas free of weeds and neatly cultivated and fine graded. All plant basins shall be in good repair. All trees shall be properly staked and tied. All planting areas shall be clear of weeds.
- C. The establishment of turfgrass is herein defined as being all work necessary to grow a full, healthy, uniform stand of smooth and even texture and grade with clean straight edges without weeds, distressed areas or bare spots, and has been mowed at least twice per the specifications. The establishment of turfgrass is further defined as being all work necessary to develop a minimum rooting depth of 2 inches into site soil.
- D. Work requiring corrective action or replacement in the judgment of the Owner's Representative shall be performed within five (5) days after the inspection. Corrective work and materials replacement shall be in accordance with the drawings and specifications and shall be made by the Contractor at no cost to the Owner. A subsequent review shall then be arranged.
- E. If after the review, the Landscape Architect is of the opinion that all the work has been performed as per the Contract Documents, and a uniform stand of healthy dense turfgrass has been established without weeds or bare spots, the Contractor will be given written notice that the maintenance period may begin.

3.16 MAINTENANCE - GENERAL

- A. After all work indicated on the drawings or herein specified has been completed, reviewed, and approved, and the turfgrass has been successfully established per the requirements below, the Contractor shall commence a ninety (90) calendar day maintenance period in which the Contractor shall continuously maintain all areas included in the contract during the progress of the work and throughout the maintenance period, or until Final Acceptance of the project, whichever is greater.
- B. Maintenance work includes monitoring the site to control all watering, replanting, fertilizing, mulching, weeding, cultivating and mowing necessary to bring the planted areas to a healthy and vigorous growing condition, and any additional work needed to keep the areas neat, edged, weed and trash free, and attractive.
- C. All trees, shrubs, ground cover shall be kept at optimum growing condition by watering weeding, replanting, fertilizing, cultivating, tree stake repair, spraying for diseases and insects, replace dead or dying materials, pruning as directed, maintaining proper grades of plants, and providing any other reasonable operations of maintenance and protection required for successful completion of the project.
- D. Any date when the Contractor fails to adequately water, replace unsuitable planted areas and other work determined to be necessary by the Owner, will **NOT** be credited as part of the establishment/maintenance period.
- E. No additional payment will be made for additional time necessary for turfgrass establishment. The maintenance period shall not start until all contract work has been completed and all close-out documents and materials have been submitted. Turfgrass will be considered weed-free if there is a maximum of one percent undesirable turfgrass species, and nine weeds or less per 50 square yards (one per 50 square feet).
- F. During the progress of the maintenance period, the Contractor and the Owner's Representative shall conduct reviews at no less than 21 day intervals to determine that ongoing maintenance activities have been conducted by the Contractor. If in the opinion of the Owner, ongoing maintenance has not been conducted by the Contractor in a satisfactory manner the maintenance period shall be suspended. The Contractor shall provide remedial work as directed

by the Owner's Representative to correct the found deficiencies and schedule another review. If after the subsequent review the work is deemed acceptable, the maintenance period shall resume.

3.17 MAINTENANCE – MOWING AND DRESSING

- A. The first two mowings of warm-season Bermudagrass varieties grown from seed/stolons shall commence when the grass is two (2) inches tall and cut down to one and one-half (1.5) inch. Mowing height for the second two mowings shall be when 1.75 inch tall and cut down to 1.25 inch. For all subsequent mowing and for new sod, mow when 1.4 inch tall and cut down to 1.0 inch.
- B. The first three mowings of Tall Fescue cool-season grass varieties shall commence when the grass is three and one-half (3.5) inches tall and cut down to three (3.0) inches. For all subsequent mowings, mow when 3.25 inches tall and cut down to 2.5 inches.
- C. The first three mowings of temporary or overseeded cool-season grass varieties shall commence when the grass is two and one-half (2.5) inches tall and cut down to one and three quarters (1.75) inches. For all subsequent mowings, mow when the grass is 2.25 inches tall and cut down to one and one-half (1.5) inch.
- D. Turfgrass areas shall be mowed during the growing season a minimum of twice a week for warm-season varieties and a minimum of once a week for cool-season varieties, or at any time the grass reaches 1.4 times its mowing height. Turfgrass shall be edged weekly. The Contractor shall coordinate his watering and weed control schedules to accommodate his mowing schedule. If the Contractor is unable to mow the turf areas on the required day, he has until 5:00 pm of the next day to do the work. After that time, the Owner reserves the right to secure the services of an alternate mowing entity to perform the work. The cost for the alternate mowing will be deducted from monies owed to the Contractor. The Contractor will remain responsible to perform all scheduled mowings and maintenance of the site. The turfgrass shall be mowed and edged, and all trash and debris removed prior to Final Acceptance.

3.18 MAINTENANCE - FERTILIZATION

- A. The Contractor shall fertilize the warm-season turfgrass (Bermudagrass) at the start of the maintenance period and every twenty-eight (28) days with the turfgrass maintenance fertilizers at a rate of 1.0 lb. of actual N, P and/or K/1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall continue the fertilizer applications until the established turf is accepted.
- B. The Contractor shall fertilize the temporary cool-season turfgrass at the start of the maintenance period every twenty-eight (28) days with the turfgrass maintenance fertilizers at a rate of 0.75 lb. of actual N, P and/or K/1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall continue the fertilizer applications until the established temporary turf is accepted.
- C. The Contractor shall fertilize the non-turf planted areas during the last week of the maintenance period with the mixed pre-planting fertilizer (14-6-11.6) at a rate of six (6.0) lbs./1,000 s.f. and as modified by the soil fertility recommendations and approved by the Landscape Architect.

3.19 MAINTENANCE – REPAIR AND WEEDING

- A. Between the twenty-first (21) day and the twenty-eighth (28) day after turfgrass planting, the Contractor shall perform the following: replant all spots or areas where normal germination or growth is not evident; remove all rocks or other debris that would constitute a hindrance to

mowing or cultivating; repair all damage done by his operations. Where poorly compacted trench backfill shows settlement, remove turfgrass or plants, fill all depressions and eroded channels with sufficient conditioned topsoil to raise to proper grade, compact lightly and replant the filled areas. Roll all planted or replanted turfgrass areas with a lightly weighted turf roller in order to provide a smooth and even mowing surface.

- B. Visible weeds shall be removed at least weekly during the maintenance period. At the end of the maintenance period, all planting areas shall be without weeds. If weeds are present, the Contractor shall manually remove the weeds and shall then apply a granular, selective pre-emergent herbicide at manufacturer's approved rates. Coordinate application with the Owner's Representative and provide certificates of application to Owner's Representative. The turfgrass will be considered weed-free if there are 9 weeds or less per 50 square yards (one per 50 square feet).

3.20 FINAL REVIEW

- A. A Final Review will not be scheduled until all Close-out Documents and materials have been submitted and accepted.
- B. A Final Review will be performed before the end of the Maintenance Period or upon the pending Final Acceptance of the work, whichever is earlier, provided all deficiencies revealed during the maintenance period have been corrected. If deficiencies have not been corrected by the end of the stated maintenance period, the Contractor shall continue to fully maintain the project at his own expense. After all deficiencies have been corrected, a Final Review will be held with the Landscape Architect, Owner's Representative, and Contractor.
- C. Final Acceptance of turfgrass is contingent on a weed free, healthy uniform stand without dead, bare or distressed areas with a minimum rooting depth of five (5) inches into site soil.
- D. If after the Final Review, the Landscape Architect and Owner's Representative are of the opinion that the work is acceptable and complete, the Contractor's maintenance responsibility shall terminate on an agreed upon date.

3.21 WARRANTY AND REPLACEMENT

- A. All trees and plants provided under this Contract shall be guaranteed to be in good, healthy, disease/pest free and in a flourishing condition one growing year from the date of Final Acceptance of the work, provided the Owner maintains the plants properly and in accordance with accepted horticultural practices. Species and size of any tree and/or plant replacements, either prior to or after Final Acceptance, shall be equal to that of the same adjacent trees and/or plants at the time of replacement as determined by the Landscape Architect.
- B. The Contractor shall be responsible to replace all lost plants due to theft, vandalism or any other preventable causes till Final Acceptance of the work by the Owner. Replacement trees and plants shall be planted as originally specified and detailed. Replacement trees and plants shall be guaranteed as specified above from the date of replacement. The maintenance period may be extended for a duration of not more than the original maintenance period duration for the establishment of replacement plants.
- C. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects or actions of trees, plants, materials, equipment or workmanship one year from the date of Final Acceptance or the Notice of Completion, whichever is later.

END OF SECTION

**SECTION 33 12 00
WATER UTILITIES**

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Pipe and fittings for on-site domestic piping.
- B. Valves and valve boxes.
- C. Accessories.

1.2 RELATED SECTIONS

- A. Contract General Conditions and Division 1 Specifications
- B. Section 31 11 00 - Site Clearing
- C. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading
- D. Section 31 22 22 - Soil Materials
- E. Section 31 23 33 - Trench Excavation and Backfill
- F. Section 32 13 13 - Site Concrete Improvements

1.3 REFERENCES

- A. ASTM Test Method D1557.
- B. ANSI/ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
- C. ANSI/AWWA C110 - Ductile Iron and Grey-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.
- D. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- E. ANSI/AWWA C500 - Gate Valves, 3-inch through 48-inch NPS, for Water and Sewage Systems.
- F. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water.
- G. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and Class 200.
- H. ASTM D2855 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
- I. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

1.4 SUBMITTALS

- A. Submit in accordance with Specification Section SUBMITTALS and the Contract General Conditions.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Contract General Conditions and Division 1 Specifications.
- B. Accurately record actual locations of piping mains, valves, connections and appurtenances, referenced to permanent surface features.
- C. Identify and describe discovery of uncharted utilities or utilities found at locations different than indicated on plans.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with product manufacturer's recommendations and these Contract Documents.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle all products required.

PART 2 - PRODUCTS

2.1 WATER PIPE

- A. Ductile Iron Pipe (for iron pipe larger than 3 inches in diameter, above ground): ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with cement - mortar lining and seal coating per ANSI/AWWA C104/A21.4.
 - 1. Fittings: ANSI/AWWA C110/A21.10, ductile iron.
 - 2. Joints: Flanged.
- B. PVC Pipe (for pipe 3 inches and smaller, underground): ASTM D1785, Schedule 40.
 - 1. Fittings: ASTM D 2464, Schedule 80 PVC (ASTM D 2466, Schedule 40 PVC for pipes 1-1/2 inches and smaller).
 - 2. Joints: ASTM D 2855, solvent weld.
- C. PVC Pipe (for pipe 4 inches and larger, underground): ANSI/AWWA C900 Class 305.
 - 1. Fittings: ANSI/AWWA C111, ductile iron.
 - 2. Joints: ASTM D 3139 compression gasket ring.
- D. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed "CAUTION - WATER LINE BELOW".

2.2 VALVES - UP TO 2 INCHES (50 MM)

- A. Use full port ball valves for 2 inches and smaller and resilient wedge gate valves for 2-1/2 inches and larger size.
- B. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends.

2.3 GATE VALVES - 2-1/2 INCHES (63 MM) AND OVER

- A. ANSI/AWWA C509, Iron body, bronze trim, non-rising stem with square nut or control handle wheel, resilient single wedge, threaded or flanged.

2.4 VALVE BOXES

- A. Precast concrete with cast iron lid marked for service. Christy No. G5 or approved equal.
- B. Valve boxes shall have a minimum 6 inch wide by 4 inch (6" inches in vehicular areas) thick concrete collar.

2.5 ACCESSORIES

- A. Concrete for Thrust Blocks and Valve Box Surface Collars: Concrete type specified in Specification Section SITE CONCRETE IMPROVEMENTS.
- B. Valve Boxes and Covers: Christy No. G5 traffic box, or approved equal. Cover marking shall read "Water". A one-piece PVC riser extension shall be provided as necessary to allow unobstructed access to valve operating nut.
- C. Solvent Cement and Primer for PVC Pipe and Fittings: Per ASTM F656 and ASTM D2564.
- D. Non-Firming Anticorrosion Wrap: Trenton Wax-Tape #1 or approved equal for application on belowground metal surfaces, pipe, or fittings in corrosive soils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions. All plot dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and report any variations to the Engineer.
- B. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. Carefully investigate the structural and finished conditions affecting all work, and plan work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Unless dimensions are shown, drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between water systems, planting, and architectural features will be minimized.
- C. Do not install the facilities as indicated on the drawings when it is obvious in the field that unknown obstructions might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Engineer before proceeding.

3.2 PREPARATION

- A. Prepare for pipe installation by assembling all needed materials.
- B. Cover all PVC pipe during storage.

3.3 BEDDING

- A. Excavate trench, pit or hole in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL.

- B. Where trench or pit has been overexcavated, place bedding material at bottom of excavations, level soil materials in continuous layers not exceeding 8-inches loose uncompacted depth.
- C. Backfill around sides and to a level 6-inches above the top of pipe with bedding sand, tamped in place.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE AND FITTINGS

- A. Install pipe at locations and depths indicated on plans.
- B. Install pipe, fittings, and associated materials in accordance with manufacturer's recommendations.
- C. Route pipe in straight line, whenever possible. All changes in direction of pipes shall be made with fittings, not by bending.
- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- E. Form and place concrete for thrust blocks at each elbow, tee, angle or other significant change of direction in loose-joint pipe, per detail on plans.
- F. Establish elevations of buried piping to ensure not less than 30-inches of cover, except at connections to existing lines, which may be shallower or deeper, or where shown otherwise on plans.
- G. When two water pipes are to be installed in same trench, maintain a minimum 4-inch horizontal clearance between pipes.
- H. Backfill trench or other excavation in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL.

3.5 INSTALLATION - VALVES

- A. Set valves on solid bearing.
- B. Where valves are installed below finish surface grade, center and plumb valve box and any necessary extensions over valve. Set box cover flush with finished grade.
- C. Pour concrete collar around top of valve box per detail on plans.
- D. Furnish and install valves and valve boxes in addition to those shown on plans as required for isolation of lines for construction and disinfection, while minimizing disruption of service to buildings, at no additional cost to the Owner.

3.6 INSTALLATION - THREADED CONNECTIONS

- A. Assemble all plastic and galvanized steel threaded pipe and fittings using an approved Teflon tape applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved Teflon tape will be required.
- B. At all plastic (PVC) pipe connections, work the ductile iron connections first. Connections shall always be plastic into steel, never steel into plastic.

- C. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of Teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

3.7 PRESSURE TESTING OF SITE WATER PIPING SYSTEM

- A. General: Unless otherwise directed, tests shall be witnessed by Inspector. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered before such tests, the Contractor shall, at his expense, uncover, test and repair his work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.
- B. Water Piping: Pressure test all onsite water piping systems in accordance with AWWA Standard C605, "Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings". The pressure testing process shall be performed in cooperation with the authority having jurisdiction and witnessed by the Owner's Inspector. The constructor shall supply an affidavit of compliance to the Owner as required by AWWA Standard 605. Maintain 150 PSIG water pressure for a duration of four (4) hours. There shall be no drop in pressure during test except that due to ambient temperature changes. Flush all lines prior to pressure test.
- C. Backflow Preventer: All backflow preventers shall be tested according to manufacturer's recommendations and the USC Cross Connection Control and Hydraulic Research Manual latest edition and per local AHJ requirements. Testing shall be performed by an AWWA Certified Backflow Prevention Assembly Tester. Contractor shall provide written certification to the Architect showing the date in which the backflow preventers were tested and confirmation that unit passed all test requirements.

3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect all domestic water piping systems in accordance with AWWA Standard C651, "Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by the Owner's Inspector. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner by the Owner's Inspector.

3.9 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of the Contract General Conditions and Division 1 Specifications.
- B. Compaction testing of bedding and backfill will be performed in accordance with ANSI/ASTM D1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest. Any retests required due to failure of initial tests shall be paid for by the Contractor.

END OF SECTION 33 12 00

**SECTION 33 30 00
SITE SEWER SYSTEMS**

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Sanitary Sewer Pipelines and Fittings
- B. Site Accessories

1.2 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division-1 Specifications sections, apply to the work of this section.
- B. Section 31 11 00 - Site Clearing
- C. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading
- D. Section 31 22 22 - Soil Materials
- E. Section 31 23 33 - Trench Excavation and Backfill
- F. Section 32 13 13 - Site Concrete Improvements

1.3 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies
 - 1. Safety Regulations: Work shall comply with all Federal, State and Municipal regulations regarding safety, including the requirements of the following:
 - a. William-Steiger Occupational Safety & Health Act of 1970.
 - b. State of California, California Administrative Code, Title 8 Industrial Relations, Chapter 4, Subchapter 4, "Construction of Safety Orders" and other State and local agencies having jurisdiction.
 - c. All trenching work shall conform to Trench Construction Safety Orders of California State Industrial Accident Commission.

1.4 REFERENCES

- A. American Water Works Association (AWWA).
- B. American Society for Testing and Materials (ASTM):
 - 1. Designation D3034 - Polyvinyl Chloride (PVC) pipe.
- C. California Plumbing Code, Latest Edition (CPC).
- D. Local County Health Department Standards.

1.5 SUBMITTALS

- A. Submit under provisions of Specification Section - SUBMITTAL PROCEDURES. Certificates of compliance for material
- B. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.
- C. Submit manufacturer's data and/or fabrication drawings for Sanitary Sewer Pipelines, Sanitary Sewer Manholes and Sanitary Sewer Fittings, installed under this Section. No items shall be incorporated into the work until submittals are approved by the Engineer.

1.6 COORDINATION

- A. Verify location of existing utilities have been indicated at by local utility authorities.

1.7 EXISTING UTILITIES

- A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by local utility authorities.
- D. Maintain all existing utility mains and service lines in constant service during construction of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sanitary sewer pipelines for pipes 4 inches and larger shall be polyvinyl chloride (PVC) pipe conforming to ASTM Designation 3034, SDR-35, with elastomeric gasket joints per ASTM D 3212 and F477.
- B. Sanitary sewer pipelines for pipe less than 4 inches shall be Schedule 40 PVC pipe, ASTM D1785.
- C. All sanitary sewer fittings shall be watertight connections using PVC sewer fittings as approved by the California Plumbing Code, or approved equal to be determined by the Civil Engineer.
- D. Surface cleanout shall be precast concrete with cast iron lid marked for service Christy G5 or approved equal and constructed as per detail drawing and current plumbing code.
- E. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed "CAUTION - SEWER LINE BELOW".

PART 3 - EXECUTION

3.1 CLEARING OF WORK SITE FOR SITE IMPROVEMENTS

- A. Clear site for improvements per construction drawing demolition plan and in accordance with Specification Section SITE CLEARING.

3.2 TRENCH EXCAVATION

- A. Trench excavation and backfilling shall be in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL and construction drawing detail.

3.3 SOIL MATERIALS

- A. Excavated materials and imported materials shall meet engineering recommendations in accordance with Specification Section SOIL MATERIALS.

3.4 PIPE INSTALLATION

- A. Pipe Laying: Alignment and elevation stakes shall be set at intervals with offsets and cut to the invert of the pipe.
 - 1. Proper facilities shall be provided for stringing and lowering sections of pipe into the trench. The pipe shall be laid carefully to lines and grades given.
 - 2. The grade line shown on the plans indicates the flow line or invert of the pipe and all cuts, unless otherwise indicated, refer to this line.
 - 3. After the trench for pipe has been brought to the proper line and grade, the pipe shall be laid in the following manner.
 - a. Pipe laying shall proceed upgrade with the bell ends of bell and spigot pipe placed upstream. Each section of pipe shall be laid to line and grade as herein specified and in such a manner as to form a watertight, concentric joint with the adjoining pipe. The interior of the pipe shall be cleared of all dirt and debris and excess joint sealing material as the work progresses. Pipe shall not be laid when the condition of the trench or weather is unsuitable. All open ends of pipe and fittings shall be adequately and securely closed whenever the work is discontinued for more than one-half hour. If pipe with elliptical or quadrant reinforcement is used, care shall be taken to properly orient the axis.
 - 4. All joint surfaces shall be cleaned before joints are made.
 - 5. The Contractor shall furnish and use, for grade and alignment control, a laser beam system which complies with OSHA requirements. The laser system shall have good visibility when used with suitable target material. The laser system must be of the self-leveling type so that the laser beam is automatically compensated for minute grade disturbances.
 - 6. The laser system must also have an early warning system that instantly warns the pipe layer when the laser is off grade. The laser system is to be provided by the Contractor and shall have a minimum accuracy of ± 0.01 foot per one hundred feet (100') on line; and a minimum visible range of one thousand feet (1000'). When conditions are such that this method is impractical, such as on short pipe runs, the Contractor shall have an Engineer on the ground to set grade of each joint of pipe by means of an Engineer's level.
- B. Sewer Systems Plugs: Temporary plugs of brick or mortar shall be installed on all sewer projects at points of connection to existing facilities. These plugs shall remain in place until completion of the balling and flushing operation. The plugs, intended to prevent water from the balling and flushing operation, drainage, or any other condition from entering the existing system, shall be installed or removed in the presence of and under the direct supervision of the Engineer. Until the system has been pumped clear of accumulated water, the plugs shall not be removed. This water must not be allowed to enter adjacent sewer or drainage systems.
- C. Internal Inspection: Upon completion of construction and prior to final inspection, the Contractor shall clean the entire new pipeline of all dirt and debris. Any dirt or debris in previously existing pipes or ditches in the area, which in the opinion of the Engineer resulted from the new installation, shall also be removed by the Contractor. Sewer pipes shall be cleaned by the controlled balling method. Temporary plugs shall be installed and maintained during cleaning operations at points of connection to existing facilities to prevent water, dirt, and debris from entering the existing facility. Temporary plugs for sewer systems shall also conform to

Subsection B, above. Water from the drainage system operations shall be routed through a suitable trap to collect any dirt and debris prior to discharging into any downstream facility. The Contractor shall notify the Architect immediately after completion of the pipe cleaning operations. Cleaning of drainage pipes by the controlled balling method will not be required.

- D. As soon as possible after the completion of the pipe cleaning, and prior to final acceptance, the Architect or Engineer may make a visual internal inspection of the new pipeline either manually or with television equipment.

3.5 COORDINATION

- A. Coordinate with the campus for the shutdown of the existing sewer system to make new sewer connection. Install sewer pipelines before making tie-in to the existing sewer pipeline. Tie-in work may proceed during the campus non-use of the existing sewer system such as on weekends.

3.6 TESTING OF SANITARY SEWERS

- A. After cleaning per Section 3.4-C, each section of sewer constructed shall be tested in accordance with acceptable "Low Pressure Air Test for Sanitary Sewers" methods such as presented in the Journal of Sanitary Engineering, Division ASCE, April 1964, to test the point of effluent disposal. All lines and components shall be leak proof.

3.7 INSPECTION OF SANITARY SEWERS

- A. System components shall be properly identified as to the manufacturer.

3.8 CLEAN-UP

- A. Remove from the site all rubbish, debris, etc. in a lawful manner, resulting from work in this Section. The clean-up shall include the replacement and repair of any damaged or disturbed property.

END OF SECTION 33 30 00

**SECTION 33 40 00
STORM DRAINAGE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY:

- A. This section includes the following:
 - 1. Provide all materials, labor, equipment and services necessary to furnish and install Storm Drainage System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. RELATED SECTIONS:
 - 1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 00 and 01 sections, apply to this work.
 - 2. Section 31 2 222 – Soil Materials
 - 3. Section 31 23 33 – Trench Excavation and Backfilling
 - 4. Section 32 13 13 – Site Concrete Improvements

1.3 REFERENCES

- A. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
- B. ANSI/ASTM C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- C. ANSI/ASTM C478 Precast Reinforced Concrete Manhole Sections.
- D. ASTM D1557

1.4 DEFINITIONS

- A. Bedding: Fill placed under, around, beside and directly over pipe, prior to subsequent backfill operations.
- B. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Certificates of compliance for material.
- C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.

- D. Submit manufacturer's data and/or fabrication drawings for all pipes, and appurtenances installed under this Section. No items shall be incorporated into the work until submittals are approved by the Architect/Engineer

1.6 COORDINATION

- A. Coordinate work with Owner's personnel.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Owner's personnel.
- C. Coordinate work with other project work.

1.7 EXISTING UTILITIES

- A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by Owner's personnel.
- D. Maintain all existing utility mains and service lines in constant service during construction of the Work

1.8 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Accurately record actual locations of utilities encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforced Concrete Pipe for pipe larger than fifteen (15) inches: ANSI/ASTM C76, Class 3, with rubber gasket joints per ANSI/ASTM C443.
- B. Storm drainage sewer pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM designation 3034, SDR 35, with elastomeric gasket joints per ASTM D 3212 for pipe fifteen (15) inches or less.
- C. Storm drainage pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM D1785, Schedule 40, for pipe three (3) inches or less.
- D. Poured in Place Concrete: Specification Section SITE CONCRETE IMPROVEMENTS.

STORM DRAINAGE

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- E. Mortar: Composed of one part, by weight, portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand, and water.
- F. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.
- G. Soil Fill for Concrete Pipe Bedding Envelope: Specification Section TRENCH EXCAVATION AND BACKFILL.
- H. Catch basins and drain inlets shall be constructed as per detail drawing.
- I. Concrete collar shall be constructed as per detail drawing.
- J. Cleanout shall be precast concrete with cast iron lid marked for service Christy G5 or approved equal and constructed as per detail drawing.
- K. All metallic pipe, fittings and appurtenances in contact with soil shall be coated or wrapped with an approved material, as required to protect it from corrosive soil.
- L. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed "CAUTION – STORM SEWER LINE BELOW".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.

3.2 PREPARATION

- A. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system.
- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- D. Protect existing structures and other improvements to remain from damage from excavation equipment and vehicular traffic.
- E. Employ equipment and methods appropriate to the work site.
- F. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas. Dewater existing drainage basins and existing drainage pipeline systems as necessary to accomplish the work.
- G. Comply with safety requirements as they pertain to excavations, per Specification Section EARTHWORK.
- H. Remove all interfering surface and subsurface improvements authorized for removal.

3.3 EXCAVATION

- A. Excavate soil required to locate existing utilities and install the work.
- B. Excavate trenches and pits per Specification Section EARTHWORK.
- C. Excavate trenches and pits to allow installation and construction of the storm drainage facilities to the alignment, grades, depths and cross-sections as indicated on the construction plans.
- D. Excavate trench to depth which is 6 inches below the outside bottom of the pipe barrel to be placed therein.
- E. Cut trenches just wide enough to allow the installation of the pipe and pipe bedding as indicated on the plans. Minimize trench width above the pipe.
- F. Provide protection to public per Division 01.

3.4 INSTALLATION AND BEDDING OF STORM DRAIN PIPE

- A. Install the pipe and fittings to the lines and grades shown on the construction plans.
- B. Install pipe and fittings in accordance with the manufacturer's recommendations, and these specifications.
- C. Unless otherwise approved by the Engineer, lay all pipe upgrade from structure to structure, with bell or socket ends of pipe upgrade.
- D. Excavate suitable bell (or socket) holes in the bedding material, so that the bells do not bear on the subgrade or bedding. Provide uniform bearing of pipe barrel on bedding material.
- E. Ensure that all joints are properly "homed" and are watertight.
- F. Bed concrete pipe in backfill or sandfill soil envelope, and compact to a minimum of 90% relative compaction. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (6 inches below the outside bottom of the pipe barrel) to a level 6 inches above the outside top of the pipe barrel.

3.5 INSTALLATION OF STORM DRAINAGE STRUCTURES AND APPURTANCANCES

- A. Install storm drainage structures as indicated on the construction plans, in accordance with the manufacturer's recommendations, and as specified herein.
- B. Construct poured-in-place concrete per Specification Section SITE CONCRETE IMPROVEMENTS.
- C. Key top of poured-in-place concrete bases for structures to receive the tongue of precast riser sections.
- D. Construct cleanout, outfall structure per detail drawing.

3.6 BACKFILLING TO FINISHED GRADE AND FINISHED GRADING

- A. Place and compact backfill per Specification Section TRENCH EXCAVATION AND BACKFILL.
- B. Conform finished surface to the lines, grades and cross-sections shown on the plans, or as otherwise directed by the Inspector.

- C. In areas to receive paving or a significant thickness of sealing material, temporarily set manhole frame and cover below finish grade, then return after final surfacing and/or pavement sealing and bring manhole frame and cover to final grade, as shown on the plans.
- D. Fine grade all finished soil surfaces disturbed to the lines, grades and cross-sections shown on the plans.
- E. Rake and smooth all finished dirt surfaces.

3.7 TOLERANCES

- A. Pipe laying tolerances:
 - 1. Above grade: Not to exceed 1/4-inch above planned grade.
 - 2. Below grade: Not to exceed 1/2-inch below planned grade.
 - 3. Alignment: Not to exceed 2 inches from planned alignment, if gradual and regular over a distance of 20 feet.
- B. Structure finish grade tolerance: Within 1/4 inch of planned grade, but must match adjacent improvements.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest at no additional cost to Owner.

END OF SECTION 33 40 00