CORDOVA VILLA ELEMENTARY SCHOOL – MODERNIZATION

INCREMENT 2

10359 S WHITE ROCK ROAD
RANCHO CORDOVA, CA 95670

FOLSOM CORDOVA
UNIFIED SCHOOL DISTRICT

DSA File No. 34-19
App. No. 02-123800
PTN. 67330-288

JULY 13, 2026

Phase 1.2
PROJECT #25010.1.2

STUDIO W ARCHITECTS

STUDIO W
ARCHITECTS

SEALS PAGE

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 02-123800 INC: 02
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 07/31/2026

SCHOOL DISTRICT: Folsom-Cordova Unified School District
SCHOOL NAME: Cordova Villa Elementary School

OWNER:
Folsom-Cordova Unified School District
1965 Birkmont Drive
Rancho Cordova, CA 95742

ARCHITECT:
Studio W Architects
1930 H Street
Sacramento, CA 95811

LICENSED ARCHITECT
BRIAN P WHITMORE
No. C 30345
Ren. 9/30/27
STATE OF CALIFORNIA

BY:_____
Brian P. Whitmore, AIA CA 30345

STRUCTURAL ENGINEER:
Universal Structural Engineering
1660 S Amphlett Blvd.
San Mateo, CA 94402

REGISTERED PROFESSIONAL ENGINEER
KEVIN T. O'KEEFE
No. S 4192
Exp. 12/31/26
STRUCTURAL
STATE OF CALIFORNIA

BY: Kevin O'Keefe
Lic # S4192

MECHANICAL ENGINEER:
LP Consulting Engineers
1209 Pleasant Grove Blvd.
Roseville, CA 95678

REGISTERED PROFESSIONAL ENGINEER
JASON DEDORA
M 34661
REN. 12-31-27
MECHANICAL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
SEAN POURVAKIL
M 32311
REN. 6-30-27
MECHANICAL
STATE OF CALIFORNIA

BY: Jason Dedora / Sean Pourvakil
Lic # M34661 / M32311

ELECTRICAL ENGINEER:
Edge E-Consulting
400 R Street
Sacrament, CA 95811

REGISTERED PROFESSIONAL ENGINEER
YIP SHING DONNY LEE
No. E 017376
ELECTRICAL
STATE OF CALIFORNIA

BY: Donny Lee
Engineer Name Lic # E017376

PLUMBING ENGINEER:
LP Consulting Engineers
1209 Pleasant Grove Blvd.
Roseville, CA 95678

BY: Jason Dedora / Sean Pourvakil
Lic # M34661 / M32311

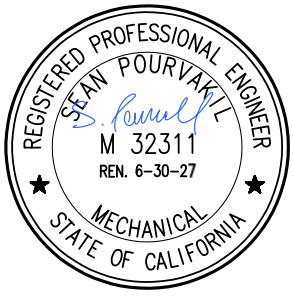
CIVIL ENGINEER:
Warren Consulting Engineers
1117 Windfield Way, Suite 110
El Dorado Hills, CA 95762

BY: Anthony J. Tassano
Lic # C74696

LANDSCAPE ARCHITECT:
MSLA Landscape Architecture, Inc.
306 Canyon Falls Drive
Folsom, CA 95630

BY:









STATE OF CALIFORNIA – DIVISION OF STATE ARCHITECT

TABLE OF CONTENTS

DIVISION 1 - GENERAL REQUIREMENTS (by CM)
014516 Field Quality Control Procedures — District
015713 Erosion Control — Warren
019100 General Commissioning Requirements — LPCE

DIVISION 2 - SITE CONSTRUCTION
024100 Site Demolition — Warren

DIVISION 3 – CONCRETE
031000 Concrete Forming and Accessories — Universal
032000 Concrete Reinforcing — Universal
032600 Adhesive anchors — Universal
033000 Cast-In-Place Concrete — Universal
033500 Concrete Finishing — Universal

DIVISION 5 - METALS
051200 Structural Steel Framing — Universal
055000 Metal Fabrications — Studio W
055134 Aluminum Ladders — Studio W

DIVISION 6 - WOOD AND PLASTICS
061000 Rough carpentry — Universal
064023 Interior Architectural Woodwork — Studio W
068200 Fiber Reinforced Plastic (FRP) Panels — Studio W

DIVISION 7 - THERMAL AND MOISTURE PROTECTION
071909 Concrete Moisture and Alkalinity Testing — Studio W
071910 Concrete Floor Sealer — Studio W
071920 Concrete Moisture and Alkalinity Barrier — Studio W
072100 Building Insulation — Studio W
072419 Exterior Insulation and Finish Systems (EIFS) — Studio W
075423 Thermoplastic Polyolefin (TPO) Roofing — Studio W
076200 Sheet Metal Flashing and Trim — Studio W
077200 Roof Accessories — Studio W
078413 Penetration Firestopping — Studio W
078446 Fire-Resistive Joint Systems — Studio W
079200 Joint Sealants — Studio W

DIVISION 8 - DOORS AND WINDOWS
081113 Steel Doors and Frames — Studio W
083113 Access Doors and Frames — Studio W
084113 Aluminum-Framed Entrances and Storefronts — Studio W
087100 Door Hardware — Allegion
088000 Glazing — Studio W

DIVISION 9 - FINISHES
092900 Gypsum Board Studio W
095113 Acoustical Panel Ceilings Studio W
096519 Resilient Tile Flooring Studio W
096723 Resinous Flooring Studio W
096816 Sheet Carpeting Studio W
097200 Wall Coverings Studio W
098319 Acoustical Wall Panels Studio W
099100 Painting Studio W

DIVISION 10 - SPECIALTIES
101100 Visual Display Surfaces Studio W
101400 Signage Studio W
102113 Toilet Compartments Studio W
102600 Wall and Door Protection Studio W
102800 Toilet and Bath Accessories Studio W
104400 Fire Protection Specialties Studio W
107500 Flagpoles Studio W

DIVISION 11 - EQUIPMENT
113100 Residential Appliances Studio W

DIVISION 12 - FURNISHINGS
122413 Roller Window Shades Studio W
129314 Bicycle Racks Studio W

DIVISION 13 - SPECIAL CONSTRUCTION
131230.1 Responsibility Matrix – CVES District

DIVISION 21 - FIRE SUPPRESSION
210500 Common Work Results for Fire Suppression LPCE
210523 General-Duty Valves for Water-Based Fire-Suppression Piping LPCE
210553 Identification for Fire Suppression Piping and Equipment LPCE
211300 Fire-Suppression Sprinkler Systems LPCE

DIVISION 22 - PLUMBING
220510 Plumbing General Provisions LPCE
220516 Expansion Fittings and Loops for Plumbing Piping LPCE
220523 General-Duty Valves for Plumbing Piping LPCE
220529 Hangers and Supports for Plumbing Piping and Equipment LPCE
220553 Identification for Plumbing Piping and Equipment LPCE
220719 Plumbing Piping Insulation LPCE
220800 Plumbing Commissioning Requirements LPCE
221005 Plumbing Piping LPCE
221006 Plumbing Piping Specialties LPCE
223000 Plumbing Equipment LPCE
224000 Plumbing Fixtures LPCE

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING
230510 Mechanical General Provisions LPCE

230529 Hangers and Supports for HVAC Piping and Equipment LPCE
230553 Identification for HVAC Piping and Equipment LPCE
230593 Testing, Adjusting, and Balancing for HVAC LPCE
230713 Duct Insulation LPCE
230719 HVAC Piping Insulation LPCE
230800 Mechanical Commissioning Requirements LPCE
230924 Direct-Digital Control System for HVAC LPCE
232300 Refrigerant Piping LPCE
233100 HVAC Ducts and Casings LPCE
233300 Air Duct Accessories LPCE
233423 HVAC Power Ventilators LPCE
233700 Air Outlets and Inlets LPCE
237223 Packaged Air-To-Air Energy Recovery Units LPCE
237413 Packaged Outdoor Central-Station Air-Handling Units LPCE
238126 Small-Capacity Split-System Air Conditioners LPCE
238129 Variable Refrigerant Flow HVAC Systems LPCE

DIVISION 26 - ELECTRICAL
260000 Electrical Work LPCE
260505 Selective Demolition for Electrical LPCE
260519 Low-Voltage Electrical Power Conductors and Cables LPCE
260526 Grounding and Bonding for Electrical Systems LPCE
260529 Hangers and Supports for Electrical Systems LPCE
260533 Raceway and boxes for electrical systems LPCE
260553 Identification for Electrical Systems LPCE
260573 Power System Studies LPCE
260800 Electrical Commissioning Requirements LPCE
262200 Low Voltage Transformers LPCE
262400 Switchboards and Panelboards LPCE
262716 Electrical Cabinets and Enclosures LPCE
262726 Wiring Devices LPCE
262816 Enclosed Switches LPCE

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
283100 Intrusion Alarm System LPCE
284600 Fire Alarm System LPCE

DIVISION 31 - EARTHWORK
310000 Earthwork Warren
312333 Trenching and Backfilling Warren

DIVISION 32 - EXTERIOR IMPROVEMENTS
320120 Detectable Warning Surfaces Studio W
321200 Asphalt Paving Warren
321600 Site Concrete Warren
321816 Playground Resilient Surfacing MSLA
328400 Irrigation System MSLA
329300 Planting Installation MSLA
329900 Landscape Maintenance MSLA

DIVISION 33 - UTILITIES
330000 Site Utilities Warren
334000 Site Drainage Warren

APPENDIX
Hazardous Materials Survey Final Report – Dated Dec 15, 2025 Entek

END OF TABLE OF CONTENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements related to inspections, tests, and related quality control procedures required to be performed by the Contractor and that facilitate the Contactor's compliance with the Contract Documents.

1.2 RELATED REQUIREMENTS

A. Section 01 3300, Submittal Procedures; submission of manufacturers' instructions and certificates.

B. Section 01 4523, Testing and Inspecting Services, and DSA 103; Special Tests and Inspections required by authorities having jurisdiction and are the responsibility of Owner.

C. Section 01 7700, Closeout Procedures.

D. Specific requirements for testing, inspections, mockups, and other quality control requirements as described in the various Sections of the Specifications.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, and unless otherwise specified, means having successfully completed a minimum of three previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

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

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

D. Mockups: Full-size, physical assemblies that are constructed on-site and in-place mockups to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, interface, testing, and operation of various building components. Mockups are not samples.

E. Tests: Procedures intended to establish the quality, performance, or reliability of a product or system conducted by a qualified Testing Agency.

F. Source Quality-Control Tests: Tests and inspections related to materials manufactured or fabricated away from the jobsite that will be incorporated into the work.

G. Testing Agency: An independent entity engaged to perform specific tests, inspections, or both, is qualified to operate in California, and meets the additional requirements specified.

1. Testing laboratory shall mean the same as Testing Agency.

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

I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include Contract administration activities performed by Architect.

1.4 REFERENCES AND STANDARD SPECIFICATIONS

A. General:

1. The Contract Documents contain references to various standard specifications, codes, practices, and requirements for materials, work quality, installation, inspections, and tests published and issued by the organizations, societies, and associations.
2. Contractor shall obtain its own copies of required specified referenced publications.
3. The specification or standard referred to shall have full force and effect as though printed in these Specifications.
4. When the effective date of a reference standard is not specified, it shall be understood that the current edition or latest revision thereof and any amendments or supplements thereto in effect on the date of the DSA approval, shall govern the Work.
5. The contractual relationships, duties, and responsibilities of the parties in Contract or those of the Architect shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

B. Products or workmanship specified by association, trade, or other consensus standards shall comply with requirements of the referenced standard or specification except when more rigid requirements are specified or are required by applicable codes.

C. Conflicting Requirements:

1. If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
2. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.

1.6 INFORMATIONAL SUBMITTALS

INCLUDE THE FOLLOWING TWO PARAGRAPHS IF A "CONTRACTOR'S QUALITY CONTROL PLAN," IS REQUIRED FOR THE PROJECT AND DELETE PARAGRAPHS C, D, AND E. INCLUDE ARTICLE 1.8 “CONTRACTOR'S QUALITY-CONTROL PLAN.”

A. [Quality Control Plan Acknowledgement].

B. [Contractor's Quality-Control Plan.]

DELETE THE ABOVE TWO PARAGRAPHS AND INCLUDE THE FOLLOWING THREE PARAGRAPHS IF A “CONTRACTOR’S QUALITY CONTROL PLAN” IS NOT REQUIRED AND DELETE ARTICLE 1.8 “CONTRACTOR'S QUALITY-CONTROL PLAN.”

C. [Schedule of Tests and Inspections.]

D. [Field Superintendent’s Quality Control Responsibilities]

E. [Procedures for inspection prior to subsequent Work or cover up.]

F. Qualifications of Contractor’s Testing Agencies.

G. Certified copies of Reports and Documents.

1.7 CLOSEOUT SUBMITTALS

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

B. Test and Inspection Log including final record for each test and inspection as specified in Part 3 and in accordance with Section 01 7839, Project Record Documents.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

RETAIN THIS ARTICLE FOR PROJECTS WHERE THE EXTENT OR COMPLEXITY OF CONTRACTOR'S QUALITY-ASSURANCE AND QUALITY-CONTROL REQUIREMENTS WARRANTS PREPARATION OF A CONTRACTOR'S QUALITY-CONTROL PLAN THAT INCORPORATES THE FORMAL PLANNING, MANAGEMENT, AND EXECUTION ACTIONS DESCRIBED. DELETE THIS ARTICLE WHEN OVERALL QUALITY CONTROL IS THE RESPONSIBILITY OF A CONSTRUCTION MANAGER.

A. General:

1. Submit a Quality-Control Plan (Plan) in format acceptable to Architect.
2. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities.
3. Coordinate and submit for review and approval concurrently with Contractor's Construction Schedule.
4. Plan shall be updated during construction as a component of the Test and Inspection Field Binder specified in Part 3.

B. Quality-Control Personnel Qualifications:

1. Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
2. Project quality-control manager **[may also serve as the Contractor's Superintendent] [shall not have other Project responsibilities]**.

C. Plan shall describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Plan shall include a Schedule of Tests and Inspections:

1. Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents[**as a component of Contractor's Quality Control Plan**] that includes the following:
   a. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
   b. Special inspections required by authorities having jurisdiction and indicated in Document DSA 103, "Structural Tests & Inspection List."
   c. Owner-performed tests and inspections indicated in the Contract Documents[, including tests and inspections indicated to be performed by the Commissioning Authority].
   d. Description of the process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to

bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

2. Include the following information in tabular form:
   a. Specification Section number and title.
   b. Entity responsible for performing tests and inspections.
   c. Description of test and inspection.
   d. Identification of applicable standards.
   e. Identification of test and inspection methods.
   f. Number of tests and inspections required.
   g. Time schedule or time span for tests and inspections.
   h. Requirements for obtaining samples.
   i. Unique characteristics of each quality-control service.
3. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.
4. Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements.
5. Comply with requirements of the California Division of the State Architect (DSA).

1.9 REPORTS AND DOCUMENTS

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

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

"LABORATORY MOCKUPS" PARAGRAPH BELOW IS USUALLY LIMITED TO NON-STANDARD STOREFRONTS AND CURTAIN-WALL SYSTEMS TO BE TESTED FOR A

PROJECT. COORDINATE WITH APPLICABLE DIVISION 08 SECTIONS WHERE THIS PRE-CONSTRUCTION TESTING WOULD BE SPECIFIED.

B. Laboratory Mockups: Comply with requirements of preconstruction testing where specified in individual Specification Sections.

1. Where services are indicated as Contractor's responsibility, engage a qualified Testing Agency to perform these quality-control services.
2. Contractor shall not employ same entity Testing Agency retained by the Owner, unless agreed to in writing by Owner.

1.10 QUALITY ASSURANCE

A. Minimum Quantity or Quality Levels:

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

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

C. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

D. Correct conditions or workmanship not in conformance with specified standards or quality. Do so immediately after non-conformance item is discovered or within a reasonable time frame agreed upon with Construction Manager.

E. Comply with manufacturers' instructions, including each step in sequence. Should manufacturers' instructions conflict with Contract Documents, request clarification from the Architect before proceeding.

F. Comply with specified standards as minimum quality for the Work, except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

G. Perform Work by persons qualified to produce required and specified quality.

H. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

I. Upon delivery to the jobsite, materials and products shall be inspected for compliance with the Project Specifications.

1. Nonconforming materials, products, equipment, hardware, tools and/or safety devices shall be removed immediately from the general work area and stored within a secured area approved by the Owner as “NON CONFORMING MATERIALS AREA” to ensure that defective or nonconforming materials are not incorporated into or used on the project
2. Materials or products shall not be removed from the designated area until they are deemed by the Architect to be in compliance, or until they are modified or fixed to meet the project specifications, or until they are removed from the jobsite for the purposes of disposal or shipment back to the manufacturer.

1.11 CONTRACTORS TESTING AGENCY

A. Qualifications: At Contractor’s expense, provide an independent testing laboratory nationally recognized according to 29 CFR 1910.7 and accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP,) or other independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E329; with additional qualifications specified in individual Sections; and, where required, that is acceptable to authorities having jurisdiction.

B. Testing Agency shall cooperate with Architect, ~~**[Construction Manager,]**~~ Owner’s Project Inspector, and Contractor in performance of duties.

C. Testing Agency shall provide qualified personnel to perform required tests and inspections.

D. Testing Agency shall not be authorized to release, revoke, alter, or increase the Contract Document requirements, approve or accept any portion of the Work, or perform any duties of Contractor.

1.12 TESTS AND INSPECTIONS

A. Preconstruction Testing: Where preconstruction testing is specified to verify performance requirements, comply with the following as applicable:

1. Contractor Responsibilities:
    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project unless approved by Architect in writing.

B. Tests and Inspections indicated in individual Specification Sections shall be conducted by a qualified Testing Agency. The responsibilities of the Testing Agency shall be as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, **[Commissioning Authority,]** ~~[Construction Manager,]~~ Owner's Project Inspector**,** and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submit a certified written report of each test, inspection, and similar quality-control service to Architect**[, Commissioning Authority,]** ~~[Construction Manager,]~~ and Owner's Project Inspector with copy to Contractor and to DSA.
4. Submit a final report of tests and inspections at Substantial Completion which includes a list of unresolved deficiencies.
5. Interpret tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retest and reinspect corrected work.

C. Monitoring and Documentation: Contractor shall maintain testing and inspection reports including log of approved and rejected results as specified in Part 3.

1. Include work Architect has indicated as nonconforming or defective.
2. Indicate corrective actions taken to bring nonconforming work into compliance with requirements.
3. Comply with requirements of the California Division of the State Architect (DSA).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 NOTIFICATIONS

A. Contractor shall provide the following notifications;

1. Owner's Project Inspector writing:
   a. 24 hours in advance of starting new Work
   b. 24 hours in advance of each test or inspection
2. 48 hours' prior notice, minimum, to the Testing Agency for required tests and inspections.

3.2 TEST AND INSPECTION FIELD BINDER

A. Contractor shall maintain in the Field Office a Test and Inspection Field Binder that includes a hard copy of the following documents:

1. Approved Quality Control Plan.
2. Specification Sections that apply to the respective portions of work.
3. RFI's, CCD's or other approved document that changes the work.
4. Manufacturer's Installation Instructions (MII).
5. Specific details of the Work as requested by the Inspector.
6. Test and Inspection Log.

3.3 TEST AND INSPECTION LOG

A. Prepare and maintain a record of tests and inspections using an electronic spreadsheet.

B. Include the following information:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. List pertinent detail/sheet number.
4. List pertinent Specification Section.
5. Attach manufacturer's installation inspections if applicable.
6. List and attach RFI's, ASI's or CCD's affecting the Work.
7. Date Inspector verified work is acceptable.

C. Final record for each test and inspection shall be submitted on Contractors letterhead and include the name of the responsible person to verify Work was in accordance with the approved Contract Documents.

3.4 MANUFACTURERS' FIELD SERVICES

A. When specified in respective Specification Sections, Contractor shall require supplier or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, testing, adjusting and balancing of equipment as applicable, and to make appropriate recommendations. Contractor is responsible for proper notification of manufacturer's representative before installation of applicable work and for obtaining necessary inspection certificate stating that installation was observed and approved.

B. Product Performance Verification: The supplier of products specified based on performance criteria shall, at the request of the Agency, inspect the installed product and certify conformance of the product to specified criteria under the installed conditions.

C. Manufacturer's representative shall submit written report to the Architect listing observations and recommendations.

3.5 TOLERANCES - GENERAL

A. Monitor tolerance control of installed products or portions to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.6 DIMENSIONING AND TOLERANCES FOR ACCESSIBILITY

A. While it is recognized that construction practices generally permit a level of reasonable dimensional tolerance, the installation of items subject to compliance with the Americans with Disabilities Act Accessibility Guidelines and Chapter 11B of the California Building Code, typically does not allow such tolerances. Therefore, these dimensions are to be considered absolute and will be strictly enforced. Items found to be out of tolerance may require modification and/or replacement at Contractor's expense.

3.7 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes.
2. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7329, Cutting and Patching.

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

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

END OF SECTION

[INSERT PROJECT NAME]

General Contractor Letterhead Inspection #

QUALITY CONTROL - INSPECTION NOTIFICATION FORM

Division of the State Architect IR A-24 Section 3 Duties of the Construction Contractor: Provide quality control of all work including the work of all subcontractors.

TYPE OF INSPECTION, LOCATION & DESCRIPTION

DATE WORK FIELD VERIFIED COMPLETE:

SUBCONTRACTOR:

CONTRACTOR'S QC FIELD REP:

CONTRACTOR confirms through field review that all work is in compliance with the approved contract documents.

List and attach all documents related to the work
(Drawing Details, Specification, RFI's, Submittal, Mii…)

List documents for inspection - attach to form	List documents for inspection- attach to form

Project Inspector Comments

Matt Garry, Project Inspector, DSA #1617

Division of the State Architect IRA-8 Section 1. Project Inspector is prohibited from performing "quality control" of construction. Quality control is the responsibility of the contractor.

[INSERT PROJECT NAME]

Room Number	Designation	Urinal	Flush Valve	Lav	Toilet Flush Valve	Mirror	Grab Bar	TP Holder	Seat Cover	Soap Dispenser	Paper Towel Dispenser	Napkin Disposal	Hand Dryer	Bottle Fill	Drinking Fountain
	Adult	24"	40"	29"	23"	39" Bottom	35" (Top)	27" CL Roll	42"	39"	39"	27"		38 7/8"	38 1/2" - 42"
	Adult DA	16 1/2"	40"	29"	23"	39" Bottom	35" (Top)	18" CL Roll	39"	39"	39"	27"		38 7/8"	35 1/2" Max
	Elementary	17"	38"	26"	23" (RFI 429)	36" Bottom	26" (Top)	17" Bottom	42"	34"	33"	N/A		38 7/8"	38 1/2" - 42"
	Elementary DA	14 1/2"	38"	26"	23" (RFI 429)	36" Bottom	26" (Top)	17" Bottom	39"	34"	33"	N/A		38 7/8"	35 1/2" Max
Example A106		N/A	N/A	28	22	35.5	26.25	13	51.5	34	33	N/A	N/A	N/A	N/A
Example A108		N/A	N/A	31	27	39	35	19	51	39	39	27	N/A	N/A	N/A

Owner Installed

SECTION 01 57 13 – EROSION CONTROL

PART 1 - GENERAL

1.1 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

1.2 QUALITY ASSURANCE

. General: Comply with governing codes and regulations.

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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw Wattles: Shall be new manufactured straw roles in compliance with state requirements for sediment control.

B. Hydroseed: Shall be a 3 step seeding rate consisting of:

Step 1:
Fiber Mulch @ 500 lbs/ac
Fertilizer (16-20-0) @ 250lbs/ac
Tacikfier (Plantago) @ 50lbs/ac
Seed (Blandon Brome) @ 12lbs/ac
Seed (Annual Rye) @ 9lbs/ac

Step 2:
Blown Straw @ 3500lbs/ac

Step 3:
Fiber Mulch @ 500lbs/ac
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 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Duties of Contractor
B. Duties of Commissioning Authority
C. Commissioning Plan
D. Commissioning Electronic Folder
E. Systems to be Commissioned
F. Acceptance Procedures
G. Performance Period
H. Training and Instruction

1.2 TERMS

A. Commissioning Plan: The preliminary Commissioning Plan has been prepared by the Owner's Commissioning Authority (CA), and shall be implemented by the Contractor and CA together. The commissioning plan (included) outlines the organization, scheduling, documentation, etc., pertaining to the overall commissioning process. A final plan shall be prepared after Contract Award as described below.
B. Functional Performance Testing: That full range of checks and tests carried out to determine if all components, sub-systems, systems, and interfaces between systems function in accordance with the contract documents. In this context, "function" includes all modes and sequences of control operation, all interlocks and conditional control responses, and all specified responses to abnormal emergency conditions.
C. Acceptable Performance: A component or system being able to meet specified design parameters under actual load including satisfactory documented completion of all functional performance tests, control system trending and resolution of outstanding issues.
D. Commissioning: The process to assure the Owner that mechanical and electrical equipment, controls, and systems function together properly to meet performance requirements and design intent as shown in a composite manner in the Contract Documents.

1.3 DUTIES OF CONTRACTOR

A. Collect the subcontractor and/or supplier information requested by Commissioning Authority for development of a complete Commissioning Plan, Commissioning Field Notebook, and Functional Tests and provide to the Commissioning Authority. The Contractor and appropriate subcontractors shall review these documents and confirm in writing to the Owner, Architect, and Commissioning Authority any known areas of conflict or areas requiring clarification.
B. Collect all proposed start-up and prefunctional documentation from appropriate sub contractors and provide that information to the Commissioning Authority. The

Commissioning Authority will incorporate that information into the Commissioning Field Notebook. The Commissioning Authority will provide the Contractor with the Commissioning Field Notebook/Binder

C. The Commissioning Field Notebook/Binder will be stored in the Contractors field trailer and will be managed by the Contractor. The contractor shall confirm in writing to the Commissioning Authority that systems are complete, functional and the appropriate subcontractors have completed the specified tasks and signed off all pre-function startup checklist documentation.
D. Coordinate directly with subcontractors on their specific responsibilities and contractual obligation.
E. Coordinate the required Architect, Commissioning Authority, and Owner testing participation and approval procedures, after verifying that start-up and pretests have been satisfactorily conducted and final tests are ready to be performed.
F. Review Operating and Maintenance Data provided by the various subcontractors and suppliers for verification, organization, distribution, and conformance to requirement of Contract Documents.

1.4 DUTIES OF COMMISSIONING AUTHORITY

A. The Owner will contract directly with a Commissioning Authority to direct the commissioning process through appropriate contract channels, perform functional test and recommend project completion from the commissioning perspective.
B. The duties of the Commissioning Authority are:
    1. Develop the Commissioning Plan.
    2. Develop Functional Test Procedures from final Control documentation including narrative sequences of operation, control diagrams and software code, for execution with the assistance of Contractor staff as required.
    3. Develop the Commissioning Field Notebook/Binder with appropriate documentation provided from Contractor. Provide supplemental documentation as necessary to ensure that all aspects of start-up and testing have been complete and documented prior to functional testing.
    4. Witness and verify satisfactory completion of equipment and component tests and systems and inter-systems functional performance tests.
    5. Provide site observation, functional test or other project reports in a timely manner. Document inconsistencies or deficiencies in system operations and system compliance. System deficiencies shall be forwarded to the Owners Rep and tracked with normal punchlisting activities.
    6. Review contractor schedules for start-up and functional testing. This is to be coordinated with any required building purge or owner occupancy schedules required by the Owner.
    7. Review Testing Adjusting and Balancing (TAB) reports and witness and direct TAB in verification effort.
    8. Coordinate via the Construction Manager participation of Owner’s personnel involved with equipment, component and systems performance verification and participation in required training.
    9. When commissioning has been successfully completed, recommend acceptance to the Owner.

10. Verify that appropriate Operation and Maintenance Manuals and Project redline drawings have been provided by various subcontractors.
11. Once all functional tests have been successfully completed and all outstanding issues resolved the Commissioning Authority will provide the owner with a final report of all commissioning activities that occurred during the project.

C. The Commissioning Authority will formally communicate with the Contractor via approved project channels. It is expected, however, that informal communication and coordination will be conducted directly with the subcontractors, records of all contacts will be sent to the Architect through the normal channels.

D. The Commissioning Authority is not authorized to modify, add to or revoke the requirements of the Contract Document. A change in the Work can only be made as provided in the General Conditions.

1.5 PRELIMINARY COMMISSIONING PLAN

A. This Preliminary Plan, details the implementation of the commissioning process. It includes the requirements that each party involved in the commissioning process will have to accomplish, including: sequence, scheduling, documentation requirements, verification procedures, etc.

B. Commissioning Activities:
1. The Commissioning Schedule. This schedule defines the milestones and conditions that must be achieved before system testing and other commissioning activities can commence. The schedule also includes the expected duration of the various tasks, so that the commissioning process can be incorporated into the overall construction schedule.
2. Preparation for Testing. To prepare for the system performance testing, the Commissioning Authority will examine the design and construction documents, develop with appropriate contractors Pre-functional Test Checklists of construction responsibilities that must be completed prior to testing, and develop detailed Functional Test Procedures and data forms. Using the Pre-functional Test Checklists, each subcontractor must verify that the systems they install are in compliance with the construction documents and are fully functional. Commissioning is not intended to be a testing or inspection function that replaces any of the Contractors' obligations for testing and proof of performance. Functional testing will only begin when checklists are completed by the appropriate subcontractors, initialed, signed, and returned to the Commissioning Authority accompanied with a written letter from the Contractor indicating specific system completion.
3. Functional Testing. Functional testing is performed by the Commissioning Authority with the assistance of the Contractor to verify proper sequencing, operation and performance of installed equipment and systems under realistic operating conditions. As tests are successfully completed, a functional test checklist will be used to document the testing progress.
4. Documentation. In addition to the Pre-functional Test Checklists and Functional Test Procedures, written documentation will be maintained for all other commissioning activities. Project communication reports shall be issued by the Commissioning Authority to the Contractor and key members of the commissioning team to document apparent deficiencies identified during

examination of design and construction documents, daily activities on-site, construction deficiencies, and successful or unsuccessful functional testing results. At the end of the commissioning process, all documentation will be assembled and summarized in the final commissioning report.

5. Commissioning Electronic Folder: The Commissioning Electronic Folder will be created by the Commissioning Authority and used by the contractors to identify and track all pertinent commissioning documentation required during the installation start-up and check-out phases. This Electronic Folder will be maintained by the Contractor on site and will be made available to all subcontractors for their use. The Electronic Folder provides a central location for the subcontractors and Commissioning Authority to identify, copy and organize all pertinent information.
6. Problem Resolution. When a project communication report is issued to address an identified deficiency, the Contractor shall forward the reports to the appropriate parties to initiate corrective action in an expeditious manner. Deficiencies will be tracked as part of the punch listing activity.

C. Commissioning Roles and Responsibilities
   1. The responsibilities for commissioning are divided between the Architect; the General Contractor and its Subcontractors; and the Commissioning Authority as follows:
      a. General Contractor
         1) Identify, coordinate, and incorporate commissioning activities with the Commissioning Authority and integrate into the general construction schedule.
         2) Coordinate participation of the Mechanical, Electrical, Controls and TAB Contractors in the commissioning process.
         3) Identify and coordinate delivery, start-up and related commissioning activities with vendors and manufacturer's representatives as required. Confirm accurate delivery of equipment upon receipt and forward all related manufacturer's documentation to Commissioning Authority.
         4) Forward appropriate copies of submittals, operation and maintenance manuals, and as-built drawings to the Commissioning Authority.
         5) Review the Commissioning Plan, project communication reports, and test results, and submit comments to the Commissioning Authority.
         6) In a timely manner, address issues identified during construction that may affect the commissioning process or final system performance.
         7) Conduct and provide minutes for regular commissioning meetings as determined appropriate with Owner’s Representative and Commissioning Authority.
         8) Issue written Notice of Readiness for each system identified in part 1.07 below to Commissioning Authority upon completion of all systems work, start-up and pre-functional test documentation requirements by trade contractors.
      b. Mechanical Contractor
         1) Coordinate participation of the mechanical subcontractors in the commissioning process.

2) Coordinate installation of mechanical systems and equipment with equipment suppliers, mechanical subcontractors, and electrical contractor. Verify that coordination, installation, quality control, and final subcontractor testing have been completed such that installed systems and equipment comply with construction documents.
3) Notify the Construction Manager, General Contractor and Commissioning Authority as soon as possible of any issues identified during construction that may affect the commissioning process or final system performance.
4) Provide proposed installation, start-up and pre-functional testing documentation for equipment noted in 1.07 below to Commissioning Authority for review within 90 days of Notice to Proceed.
5) Perform start-up and testing of mechanical equipment and systems and document as required with start-up reports and completion of Pre-functional Test Checklists. Reports will be stored in the General Contractors field trailer.
6) Lead verification testing of Fire/Smoke dampers and direct appropriate subcontractors in the resolution of deficiencies. Each damper and all functions of shall be tracked in a matrix-spread sheet.
7) Operate equipment and systems as required for functional performance testing.
8) Participate in the fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
9) Submit complete operation and maintenance information and as-built drawings to the general contractor for verification, organization, and distribution.
10) Provide training for the systems specified.
11) The installing contractor shall provide (complete and signed) all required “Acceptance Testing” form per 2022 California Title-24 Energy Code.

c. Electrical Contractor
1) Coordinate installation of electrical systems and equipment with equipment suppliers, electrical subcontractors, and mechanical contractor. Verify that coordination, installation, quality control, and final subcontractor testing have been completed such that installed systems and equipment comply with construction documents.
2) Notify the Construction Manager, General Contractor and Commissioning Authority immediately of any issues identified during construction that may affect the commissioning process or final system performance.
3) Provide proposed installation, start-up and testing documentation to be used for the required systems noted in the specifications and summarized in part 1.07 below to Commissioning Authority for review within 90 days of Notice to Proceed.
4) Perform start-up and testing of electrical equipment and systems and document with start-up reports and completion of Pre-functional Test. Reports will be stored in the General Contractors field trailer.

5) Operate equipment and systems as required for functional performance testing.
6) Participate in fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
7) Provide complete operation and maintenance information and as-built drawings to the general contractor for verification, organization, and distribution.
8) Provide training for the systems specified.
9) The installing contractor shall provide (complete and signed) all required “Acceptance Testing” form per 2022 California Title-24 Energy Code.

d. Controls Contractor (or Mechanical Contractor representative for distributed control components)
1) Provide Commissioning Authority and Mechanical Contractor with controls system and wiring diagrams and narrative sequences of operation, approved by the Mechanical design consultant, in time for use in preparing the Functional Test Procedures.
2) Review the Commissioning Plan, schedule, and Functional Test Procedures. Provide input required to develop final plans and procedures as a fair means of compliance with commissioning goals and the project contract.
3) Participate in efforts to finalize sequences of operations with Owner, Designers, and Commissioning Authority.
4) Coordinate installation of controls system with equipment suppliers, mechanical subcontractors, and electrical contractor. Verify that coordination, installation, quality control, and final subcontractor testing have been completed such that installed systems and equipment comply with construction documents.
5) Notify the Commissioning Authority, Designers and Construction Manager as soon as possible of any system installation issues identified during construction that may compromise system control capability.
6) Participate in start-up and functional testing as required. This will require dedicated, full-time support of the Commissioning Authority’s functional testing efforts during commissioning.
7) Provide proposed installation, start-up and testing documentation to be used for the required systems noted in the specifications and summarized in part 1.07 below to Commissioning Authority for review within 90 days of Notice to Proceed.
8) Complete Pre-functional Test Checklists and other supporting documentation as required demonstrating completion of control system installation, point-to-point verification (including sensor calibration), start-up and testing prior to the initiation of functional testing. Reports will be stored in the General Contractors field trailer.
9) Support the Commissioning Authority in functional testing of each of the systems. The Controls Contractor shall manipulate the controls systems to achieve the expected response for the functional test procedure.

10) Participate in fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
11) Provide the Commissioning Authority and Construction Manager with final documentation for all installed conditions, including as-built drawings and detailed narrative sequences of operation as determined during commissioning process.
12) Coordinate activities as necessary with Test, Adjust and Balance Contractor as required for determining appropriate equipment and device locations, identifying and recording various set points and calibration values, and documenting same to Commissioning Authority.

e. Test, Adjust, and Balance Contractor
f. Review the Commissioning Plan, schedule, and Functional Test Procedures. Provide the input required to develop final plans and procedures.
    1) Provide a Contract Documents Examination report indicating a review of Drawings, Specifications, Issues, Field Notices and A/E reviewed submittals. Verify that piping, instruments, wells, taps, valves, ductwork, duct specialties, dampers, flow measuring elements, access openings and other accessories; have been provided in correct quantity and at correct locations to permit balancing of piping and air systems under testing and operating conditions.
    2) Coordinate balancing activities with those of the Mechanical and Controls contractors. Verify that coordination, installation, quality control, and final subcontractor testing have been completed to allow proper balancing work to be performed.
    3) Notify the Commissioning Authority, Designers and Construction Manager as soon as possible of any system installation or performance issues that may compromise the ability of the system to be balanced.
    4) Participate in start-up and testing as required.
    5) Complete appropriate portions of mechanical, electrical and TAB Pre-functional Test Checklists to verify completion of system balancing tasks. Reports will be stored in the General Contractors field trailer.
    6) Organize and run a Pre-Balance Conference one week prior to commencement of balance work. At this juncture, all Contractors are to provide a comprehensive list of any outstanding design, installation or performance deficiencies which may impede TAB or functional testing activities. This will address those items not already resolved during installation verification and pre-functional testing deficiency tracking process.
    7) Provide preliminary TAB report, indicating all actual field values recorded, to the Commissioning Authority, prior to initiation of functional testing. These reports shall be incorporated in the Commissioning Field Notebook
    8) Participate in fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
g. Commissioning Authority
    1) Perform commissioning submittal review to verify suitability and compliance with specifications.

2) Revise the Commissioning Plan as necessary to incorporate post-award conditions.
3) Provide supplemental Pre-Functional Test documentation forms for all equipment to be commissioned with coordination of subcontractor's specified documentation. Documentation will be coordinated by the Commissioning Authority and installed in a Commissioning Electronic Folder. The Electronic Folder will be created by the Commissioning Authority and maintained and managed the by General Contractor.
4) Organize meetings to finalize the controls system I/O Points List and Sequences of Operation as needed. The meeting will be supported by the Owner's Representative, Designer and Controls Contractor.
5) Write Functional Test Procedures and transmit to subcontractors for review. After review period changes will be incorporated and test will be performed.
6) Perform site observations to follow installation progress, and to verify system installation quality and readiness for testing.
7) Observe the start-up activities and initial testing of equipment and systems as required, and review contractor start-up documentation. Verify that the specified training schedule of Owner's personnel is provided.
8) Review submittal of all required Pre-functional and start-up documentation provided by contractors for completeness and reasonableness. This includes Controls Subcontractor's point to point checklists and TAB Subcontractor's completed preliminary TAB report prior to initiation of functional testing.
9) Direct and perform functional test with assistance from subcontractors as required.
10) Issue project communication reports as necessary to document activities, progress, and deficiencies.
11) Assemble all test results and other required documentation into the final commissioning report.

D. The functional test procedures include, but are not limited to, the following:
1. Verification of Testing, adjusting and balancing performance;
2. Verification of all equipment performance;
3. Verification of the performance of subsystems consisting of combinations of equipment (i.e. refrigeration cycle, pumps, chillers, cooling towers, and interconnecting piping);
4. Verification of the performance of the automatic controls in all seasonal modes;
5. Verification of the performance of the HVAC system as a whole;
6. Verification of the performance of all life safety devices and systems as the interface with the HVAC systems.
7. Verification of third party testing and documentation review.

1.6 COMMISSIONING ELECTRONIC FOLDER

A. The Commissioning Electronic Folder will be assembled by the Commissioning Authority and use by the contractors to identify and track all pertinent commissioning

documentation. This Electronic Folder will be maintained by the Construction Manager on site and will be made available to all subcontractors for their use. The Electronic Folder provides a central location for the Commissioning Authority to identify, copy and organize all pertinent information and will include the following format:

1. Summary describing Electronic Folder contents and use.
2. Copy of Commissioning Plan for contractor field reference.
3. Listing of all specification documentation requirements listed by specification section, with construction completion sign offs for appropriate parties.

B. Tabs for each specification section with copies of pre-functional test check sheets provided by coordination of subcontractors and Commissioning Authority for contractor completion and space for related contractor-supplied documents.

1.7 CALIFORNIA TITLE-24 COMMISSIONING SCOPE:

A. Per 2022 California Energy Code Part 6, Title 24/CalGreen requirements, LP Engineers will coordinate and lead, review and oversee the completion of the following commissioning process activities:

1. Design Review:
   a. Schematic Design Phase: meet with design team to discuss project scope, schedule and how the team will coordinate. The design team shall review the “Design Review Checklist” form NRCC-CXR-02-E. Form NRCC-CXR-01-E shall be provided to document the Design Review Kickoff.
   b. Construction Documents Design Review: The construction documents shall be reviewed in accordance with CEC Section 120.8 (d). The design review forms NRCC-CX-02-E, NRCC-CX-03-E, NRCC-CX-04-E and NRCC-CX-05-E shall be completed as applicable.
2. The Owner will document the Owner’s project requirements. The design team will document the basis of design for the Project. The Owner and the design team shall make updates to these documents during design and construction. LP Engineers will facilitate this process and review the documents for clarity and completeness.
3. LP Engineers will develop and incorporate commissioning requirements into the construction documents specifications.
4. LP Engineers will develop and utilize a commissioning plan that will be used throughout the commissioning process.
5. LP Engineers will verify that the installation and performance of energy consuming systems meet the Owner’s project requirements and basis of design.
   a. Conduct Commissioning Meetings as deemed necessary by the CxA with the construction team throughout the duration of the project to review progress to date, any commissioning issues, documentation and reporting.
   b. Conduct Commissioning Site Observations throughout the duration of the project as deemed necessary by the CxA. Construction progress and installation will be reviewed and a Site Observation Report submitted after each visit.
6. Review installing contractor provided “Acceptance Test” checklists to confirm that individual components of a system are installed properly per California Title-24.

7. Contractor Submittal Review:
   a. Review contractor submittals applicable to systems being commissioned.
8. Develop Functional Testing Procedures to be carried out by the contractors, witness and record the results. The Functional Test Results will be evaluated to confirm that the commissioned systems are functioning in accordance with the Owner's Project Requirements and the Basis of Design.
9. System Manual:
   a. Develop a system manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.
10. Operating Personnel Training:
    a. Verify that the requirements for training operating personnel and building
    b. occupants are completed.
11. Exclusions: LP Engineers will not provide the "Acceptance Testing Forms" (Envelope, Mechanical, Plumbing, Process and Electrical). The installing contractor shall provide (complete and sign) all required "Acceptance Testing" forms per 2022 California Title-24 Energy Code.
12. LP Engineers will complete a Commissioning Report which will include at a minimum:
    a. An Executive Summary with results of the Commissioning Process including observations, conclusions and any outstanding items.
    b. A Commissioning Issue Log identifying deficiencies discovered during the commissioning process, how they were resolved and any seasonal testing scheduled for a later date.
    c. System performance test results including the Start-up Pre-functional Checklists and Functional Test Results.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Operating equipment and systems shall be tested in presence of Owner's Commissioning Authority and Architect to demonstrate compliance with specified requirements.
   1. Notify Owner, in writing, seven (7) days prior to tests scheduled under requirements of this Section.
   2. Testing shall be conducted under specified design operating conditions as recommended or approved by Owner and Architect.
B. Functional Performance Testing shall be completed and accepted by Owner as a condition of Final Completion.
C. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each subsystem, followed by entire system, followed by entireties to other major systems.

D. All special testing materials and equipment shall be provided by Contractor.
E. Acceptance Documentation. A copy of the Commissioning Plan and Functional Performance test results shall be included with each copy of the Operations and Maintenance Manuals.

3.2 ACCEPTANCE PROCEDURES

A. Prior to functional performance testing of each system, the Commissioning Authority shall observe and verify that the physical installation of components and systems being tested is substantially installed in accordance with the contract documents.
B. Contractor's Tests:
   1. System shall be checked for proper installation, shall be adjusted, and shall be calibrated to verify that it is ready to function as specified.
   2. All system elements shall be checked to verify that they have been installed properly and that all connections have been made correctly.
   3. All discrete elements and sub-systems shall be adjusted and shall be checked for proper operation.
   4. Start-up and Operational Tests shall be complete, with all required pre-functional testing documentation included in the Field Commissioning Electronic Folder submitted for review by Commissioning Authority within five (5) days of each activity, prior to starting Functional Acceptance Tests.
C. Owner-Witnessed Functional Tests:
   1. Objective of these tests is to demonstrate that system is operating and complying with specified performance requirements.
   2. Owner-witnessed Functional Performance Tests shall be performed on complete system. Each function shall be demonstrated to satisfaction of Architect and Owner’s Commissioning Authority on paragraph-by-paragraph basis of Commissioning Authority's written test procedure, developed to demonstrate conformance to requirements of Contract Specifications.
   3. Functional Performance Test shall be witnessed and signed off by Commissioning Authority upon satisfactory completion.
   4. Actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required herein.
   5. Contractor shall notify Architect and Owner at least two weeks prior to date of Functional Performance Tests.
D. The functional performance testing process shall be accomplished for all equipment, subsystems, systems, and system interfaces. All must be tested for acceptances, and there shall be a separate checklist for each to ensure documentation specific to each is complete.
E. Each system shall be operated through all modes of system operation (for example, seasonal, occupied, unoccupied, warm-up, cool-down, etc, as applicable) including every individual interlock and conditional control logic, all control sequences, both full-load and part-load conditions, and simulation of all abnormal conditions for which there is a specified system or controls response.
F. Temporary upsets of systems, such as distribution fault, control loss, setpoint change, equilibrium upset, and component failure, shall be imposed at different operation loads to determine system stability and recovery time.

G. When the functional performance of all individual systems has been proven, the interface or coordinated responses between systems shall be checked. The systems involved may be within the overall HVAC work, or they may involve other systems, such as emergency systems for life safety.

H. Corrective Measures: If acceptable performance cannot be achieved, then necessary corrective measures shall be carried out by the Contractor. Every check or test for which acceptable performance was not achieved shall be repeated after the necessary corrective measures have been completed. This re-testing process should be repeated until acceptable performance is achieved. The Contractor will be allowed one retest after initial testing of the equipment. If the retest fails the contractor shall be financially responsible, at standard rates, to reimburse the owner representatives for the additional time taken to achieve acceptable performance.

3.3 TRAINING AND INSTRUCTION

A. Training and instruction of Owner personnel is a part of the commissioning process and essential for the proper operation of the facility. The Contractor shall coordinate commissioning activities with training of Owner personnel. Detailed requirements for training and instruction are contained in other sections of the Contract Documents including, but not limited to, Divisions 22, 23, and Division 26.

SECTION 02 41 00 – SITE DEMOLITION

PART 1 – GENERAL

1.1 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 57 13, Erosion Control

B. Section 31 00 00, Earthwork.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.

B. Coordinate clearing Work with utility companies.

C. Maintain emergency access ways at all times.

D. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.4 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.

1.5 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.

1.6 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, the Contractor shall be solely and completely responsible for working conditions at the job site, 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 on site. Demolish roofs, walls and other building elements in such manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends.
   1. Protect existing items which 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: The 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 the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

G. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The 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.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions of work in place before beginning work; report defects.

B. Report existence of hazardous materials or unsafe structural conditions.

3.2 PREPARATION

A. Scheduling:
   1. General: Coordinate and schedule demolition work as required by the 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 the 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 Owners 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. The 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 the Owner and all protective measures are in place.

E. Coordinate the time and duration of all system disconnects with Owner.

3.3 DEMOLITION

A. General Requirements

1. Clear areas required for access to site and execution of Work, including pavements, 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.

3.4 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 the 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.

3.5 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.

3.6 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 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 which 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 1 inch in diameter to a depth of two feet below existing or finished grades, whichever is lower and a minimum of five feet beyond the edge of paving, structure, wall or walkway.
   4. Hand cut existing tree roots over 1 inch 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.
   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.

3.7 DISPOSAL

Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.

A. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.

B. It is recommended 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).

C. Burning and Burying of Materials: NOT ALLOWED.

D. 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.

E. Remove demolished materials and debris from site on a daily basis.

3.8 CLEANING

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

B. Clean excess material from 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 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Form work for all cast-in-place and site-precast concrete, including accessories such as anchors, clamps and snap ties.

2. Architectural form liner where shown on drawings.

3. All required forming materials necessary to complete the formwork, including anchors, clamps, snap ties, etc.

4. Shores, scaffolds and braces required to support formwork.

5. Installation only of all hardware embedded in concrete, including anchor bolts, inserts, beam and column connections except as excluded below.

6. Installation only of all reglets, wood nailing blocks and strips, masonry anchors and chamfer strips embedded in concrete.

7. Installation only of sleeves, anchors, inserts, etc., required for the mechanical, electrical, fire sprinkler and plumbing systems, in accord with layouts furnished under appropriate Sections, when these inserts penetrate or are anchored to forms.

8. Removal of forms.

B. Related Work Specified Elsewhere:

1. Installing such items as inserts, sleeves, and anchors when not penetrating or fastened to forms.

2. Furnishing, only, of anchors, bolts (other than ledger anchor bolts), frames, hardware, inserts, reglets, sleeves and other materials or items required for electrical, plumbing and other systems, or as permanent part of structure.

3. Furnishing and installation of architectural concrete form liners.

4. Furnishing, only of pick-up inserts for erection of precast concrete.

5. Sand forming and/or casting beds at exposed aggregate finishes at precast elements.

6. Patching and filling of form tie holes.

1.2 REFERENCES, CODES AND STANDARDS

A. The following references, codes and standards are hereby made a part of this Section and formwork shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

1. Standard Specifications: The American Concrete Institute (ACI) "Specifications for Structural Concrete for Buildings" ACI 301 latest edition shall be used as a standard specification. All formwork shall conform with the standard specification except as modified by the requirements specified herein and /or the details on the drawings.

2. Codes: The current edition of the California Building Code (CBC), Chapter 19A, "Concrete". All formwork shall meet the requirements of this code. This code supplements the standard specification and shall supersede the standard specification in cases where provisions are in conflict.

3. "Building Code Requirements For Reinforced Concrete", American Concrete Institute (ACI) Document 318, latest edition.

4. "Recommended Practice For Concrete Formwork", American Concrete Institute (ACI) Document 347, latest edition.

5. Construct and erect concrete formwork in accord with ACI 318, ACI 347 and applicable construction safety regulations for place of Work.

6. "Product Guide to Grades and Specifications", American Plywood Association (APA), latest edition.

7. "Western Lumber Grading Rules", Western Wood Products Association (WWPA), latest edition.

1.3 ALLOWABLE TOLERANCES

A. Design, construct, set, and maintain the formwork so as to insure completed work within the suggested tolerance limits specified in ACI 347, Section 3.3.1. See Concrete Finishes Section for traffic surface tolerances of slabs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All formed surfaces shall be Douglas Fir plywood "Plyform" or S4S Douglas Fir boards or planks of standard grade or better.

B. Lumber, plywood and Sonotube used for forming:

1. Plywood: B-B(Conc Form) Class 1: PLYFORM(APA) or equal.

2. Boards: Douglas Fir, 3 COMMON or better, S4S(WWPA).

3. Studs, braces, wales, other shoring: material capable of supporting required loads without displacement.

4. Designated “Architectural Concrete” Surfaces: Use overlaid plywood complying with U.S. Product Standard PS-1, “A-C or B-B high density overlaid concrete form”, Class, I.

5. Provide Sonotube “smooth form round column” at circular columns.

C. Metal pan forms: of optional manufacture, sufficiently strong and of shapes to meet Drawing and Specification requirements.

D. Re-use: allowed, of lumber, plywood and metal, if materials are straight, clean, free of dirt and hardened concrete and if all surfaces and edges are in good condition.

E. Form hardware: subject to approval of Engineer, if passing through concrete sections, to be removed after pours. Furnish hardware of nature so not to impair the strength or appearance of the finished work, and that will leave no metal portions in concrete closer to the surface than 1 inch.

F. Form oil: approved non-staining mineral oil.

G. Form lining for architectural concrete shall be smooth surfaced tempered hard board or plastic overlaid plywood.

H. Form Liner shall be Interform Pattern No. 1505, 1-1/2 inch x 1-1/2 inch.

I. Wood Sill Anchor bolts: ASTM A307 with malleable iron or steel plate washers. All such inserts shall be of the same bolt size as the specified anchor bolt and shall have CBC approved shear and tensile strength ratings at least equal to those listed in the CBC for the anchor bolt specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design, construct and erect forms in accord with ACI-347.

B. Make forms of plywood, boards or metal; mortar-tight, sound, sufficiently strong and rigid to prevent distortion during pouring and curing of concrete. Build forms true to

required lines and maintain them until concrete has hardened sufficiently to permit removal. Do not use wire ties or wood form spreaders.

C. Anchor edge forms at slabs (and tilt-up panels) securely. Build forms strong enough to support screeds. Establish screed levels to obtain required slab thicknesses and slopes shown.

D. Use plywood sheets of largest practical size to form exposed surfaces, except when one board is sufficient to cover entire surface. Chamfer corners 3/4 inch unless otherwise shown.

E. Locate hardware accurately and anchor securely to forms or other falsework. Use metal or wood door and window frames when they are so adaptable.

F. Locate hardware accurately and anchor securely to forms or other falsework.

G. Be responsible for insuring that hardware shown embedded in concrete is in place prior to pour.

H. Apply form oil to boards or plywood surfaces, not mill-oiled, before reinforcing is placed.

I. Use earth trenches or excavations for footings if soil condition permits, however, use other materials to form sections of footing which are exposed. Increase horizontal footing dimensions by 1 inch, minimum, from dimensions shown, when earth forms are used.

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

K. Construct formwork, shoring and bracing to meet design and code requirements, so that resultant finished concrete conforms to required shapes, lines and dimensions.

L. Obtain Architect/Engineer's review before framing openings in structural members which are not indicated on drawings.

M. Do not apply form release agent where concrete surfaces will receive finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

N. Place anchor bolts accurately at the location and elevations shown on the drawings.

3.2 REMOVAL OF FORMS

A. Remove forms at times specified in SECTION 033000-CONCRETE. Remove forms without damage to concrete. Remove forms below ground surface, along with shores and braces, before backfilling.

B. Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, and construction and design load which are liable to be imposed upon it.

C. Edge forms 8 inches or less in height at slabs and panels, and forms at foundations and curbs shall remain in place twenty-four (24) hours after pouring.

D. Forms for cast-in-place wall columns and bond beams shall remain in place forty-eight (48) hours after pouring. At cast-in-place walls, beams and columns (other than columns at tilt-up wall closures) forms shall remain in place five (5) days minimum after pouring and shall not be removed until concrete has set adequately to prevent damage during and after removal.

E. Remove formwork progressively and in accord with code requirements so that no shock loads or unbalanced loads are imposed on structure.

F. Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.

G. Store removed forms for exposed architectural concrete in manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. All concrete reinforcing shown on the drawings.

2. Supports and ties for reinforcement.

B. Related Work Specified Elsewhere:

1. Furnishing and placing of anchor bolts, anchors, inserts for attachment to concrete work.

2. Providing anchor bolts, anchors, and inserts for attaching to concrete work.

1.2 REFERENCES, CODES AND STANDARDS

A. The following references, codes and standards are hereby made a part of this Section and reinforcement shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

1. "Manual of Standard Practice for Detailing Reinforced Concrete Structures," ACI 315, latest edition.

2. "Building Code Requirements for Reinforced Concrete," ACI 318, 2019 Edition.

3. "Manual of Standard Practice" published by CRSI, Latest Edition.

4. California Building Code (CBC), 2022 Edition, Chapter 19A.

1.3 SOURCE QUALITY CONTROL

A. Be aware that testing and inspecting related to work of this Section is not included in the Contract. Note that such work, if required for prosecution of the Project, will be contracted and paid for separately by the Owner; if not required, the work may or may not be done by the Owner or others under separate contract to him during course of construction, at his option. Be responsible for notifying the Owner sufficiently in advance, in case of action necessary for completion of the Work, to permit such action to be taken in accord with Project schedule.

B. Where certified mill test reports (required hereinafter under "Submittals") are not furnished, conform to the following:

1. Reinforcing bars shall be tested in tension and bending as per ASTM A 615. Testing shall be done by the Owner's testing agency. Furnish one copy of test reports to Architect, Structural Engineer, Owner and Contractor.

2. Samples will be taken by the testing agency from bundles as delivered from the mill. Where bundles are identified by heat number and a mill analysis accompanies the reports, one tensile and one bending test specimen will be taken from each 10 tons or fraction thereof, of each size and kind of bar. Where positive identification of heat numbers cannot be made or where random samples are taken, one series of tests shall be made from each 2-1/2 tons or fraction thereof, of each size and kind of bar.

3. The cost of test, sampling and handling of reinforcing steel shall be paid by the Owner but deducted from moneys due the Contractor.

4. Include material required to provide samples for testing.

C. The following is subject to Special Inspection as per CBC, Chapter 17A costs therefore will be paid by the Owner except that where welding of reinforcing steel is requested by the Contractor and not required by the Drawings, inspection costs therefore shall be paid by the Contractor.

1. Placement of reinforcing steel as required by Sec. 1705A.3

2. Welding of reinforcing steel as required by Sec. 1705A.3.

1.4 SUBMITTALS

A. Shop Drawings:

1. Fully detailed shop drawings, including bending schedules and bending diagrams, shall be submitted to the Architect for review. Shop drawings shall show placing details and size and location of reinforcing steel and any welding proposed. Shop drawings shall show method of chairing reinforcement in panels including chair sizes and spacing.

2. Shop drawings shall be of such detail and completeness that fabrication and placement at the site can be accomplished without the use of project or contract drawings for reference.

3. Contractor shall check architectural, structural, mechanical, and electrical project or contract drawings for anchor bolt schedules and locations, anchors, inserts, conduits, sleeves, and any other items which are required to be cast in concrete, and shall make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.

4. Reinforcing steel shall not be fabricated or placed before the shop drawings have been reviewed by the Structural Engineer and returned to the Contractor. Review of shop drawings by the Structural Engineer will not relieve the Contractor of responsibility for errors or for failure in accuracy and complete placing of the work.

B. Mill Test Reports: Certified mill test reports (tensile and bending) for each heat or melt of steel shall be submitted to the Architect before delivery of any material to the job site. (See requirements above under "Source Quality Control.") Where reinforcing is required or requested to be welded, mill test reports shall verify the weldability of the steel.

1.5 DELIVERY AND STORAGE

A. Deliver reinforcing to site properly bundled and tagged, and store so as to prevent excessive rusting or fouling with grease or any coating that will interfere with bond. Segregate so as to maintain identification after bundles are broken. Do not use damaged, reworked, or deteriorated material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing shall conform to ASTM A615, Grade 60. ASTM A615 Grade 60 required 80,000 psi minimum tensile strength with 1.10 minimum ratio of actual tensile strength to actual yield strength based on mill testing.

B. Wire spirals for column reinforcing - ASTM A-82.

C. Tie Wire: 18 ga. or heavier, black annealed.

D. Metal reinforcing supports: Galvanized, except that all supports used at wall or slab surfaces exposed to exterior in the completed building shall be aluminum or plastic coated, of an approved manufacturer. Paint does not constitute protection for such surfaces.

E. Smooth dowels at construction joints: A615, grade 40, plain billet-steel bars, or any mild-steel rod stock of 30000 psi or greater yield strength. Ends of dowels shall be smooth, without "rivet" heads or deformations of any kind.

2.2 FABRICATION

A. Comply with details on Drawings.

B. Where specific details are not shown or noted, do detailing and fabrication in conformance with or superior to requirements contained in the References, Codes and Standard Article.

C. Clean bars of loose rust, loose mill scale and any substance which may decrease bond. Bend bars accurately to details on reviewed shop drawings. Unless otherwise permitted by the Structural Engineer, bars shall be bent cold.

D. Shop fabricate reinforcement.

PART 3 - EXECUTION

3.1 PLACING

A. Conform to latest Code of Standard Practice of the Concrete Reinforcing Steel Institute.

B. Use bars free of scale, rust, mud and oil. Bend material cold, to the shapes shown. Lap splices per the drawings, unless otherwise shown. Locate splices subject to the approval of Engineer. Make splices in structural beams, slabs and columns only where shown.

C. Place reinforcing steel accurately and fasten securely into position. Use sufficient supports and ties to permit walking on reinforcing without undue displacement.

D. Place reinforcing bars to give following minimum concrete cover:

1. Concrete cast against and permanently exposed to earth-----3 inches

2. Concrete exposed to earth or weather:
   No. 6 through No. 18 bars----------2 inches
   No. 5 bar, W31 or D31 wire, and smaller----------1 1/2 inches

3. Concrete not exposed to weather or in contract with the ground
   Slabs, walls, joists:
   No.14 and No. 18 bars----------1 1/2 inch
   No.11 bar and smaller----------3/4 inch

4. Beams, columns: Primary reinforcement, ties, stirrups, spirals-1-1/2 inch

5. Shells, folded plate members:
   No. 6 bar and larger ----------3/4 inch
   No. 5 bar, W31 or D31 wire, and smaller----------1/2 inch

E. Make minimum spacing between parallel bars one bar diameter, but not less than one inch, whichever is greater. Where parallel reinforcement is placed in two or more layers, bars in the upper layer shall be placed directly above bars in the bottom layer with clear distance between layer not less than 1 inch.

F. Tie reinforcement securely in place prior to pouring concrete. Do not place dowels or other reinforcing in wet concrete.

G. All 90, 135, and 180 degree hooks are ACI standard bends and extension lengths unless noted otherwise on the Drawings. Hooks may be racked at an angle when the concrete dimensions interfere with placement.

H. Elements shall be correctly and accurately positioned and plumbed in their assigned positions. Elements shall be securely and adequately braced by approved methods until the permanent closures, anchors, and bracing are completed.

I. Do all cutting and drilling of precast items as required to accommodate other work. All cutting shall have the prior approval of the Architect and Engineer.

J. Where shims, wedges, or "buttons" are to be used for setting items, they shall be of non-staining metal or other approved material.

K. When metal connections have been completed, apply a coat of primer to all damaged shop-coated surfaces.

3.2 CLEANING

A. Clean all exposed surfaces free of mortar, laitance, and construction soil. Do not use wire brushes or any acid solutions. Take special precautions to remove all alkalis and other compounds from surface of units which might cause etching of glass or metal surfaces due to run-off from rain or window cleaning operations.

3.3 PROTECTION

A. Protect all units exposed in the finished work from stains or damage during remainder of construction period. Units which may become stained or damaged shall be cleaned or repaired, provided that such actions can restore the units to their original appearance and condition. Where structural damage results or where remedial work is not satisfactory to the Architect, units shall be replaced at no additional cost to the Owner.

B. Protection shall be considered the responsibility of the erector until the installation is approved by the Architect.

END OF SECTION 032000

SECTION 032600-ADHESIVE ANCHORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Dowels installed in new concrete by drilling and epoxy grouting.

B. Related Work Specified Elsewhere:
   1. Reinforcing bar dowels.
   2. Steel bar threaded rod.

1.2 REFERENCES, CODES AND STANDARDS

A. The following references, codes and standards are hereby made a part of this Section. Adhesive anchor work shall confirm to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.
   1. California Building Code, Current (2022) Edition, including local amendments.
   2. “Standard Specifications”, American Society for Testing and Materials (ASTM).

1.3 QUALIFICATIONS

A. Grouter’s Qualifications for Epoxy Grouting
   1. Experienced in epoxy work in general and in grouting dowels into concrete and into unreinforced masonry in particular.
   2. To employ field personnel with minimum one year’s experience installing epoxied dowels into unreinforced masonry

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   1. Product data and manufacturer’s recommended application procedures for epoxy grout.
   2. Submit results of proof testing to Architect and Engineer.
   3. Certificates of Compliance.
      a. Qualifications of field personnel performing epoxy grouting.
   4. Batch test reports for each batch of product delivered to site. Provide manufacturer’s written certification that each batch delivered meets these Specifications, the intended uses on projects including capability to bond to damp masonry surfaces. Certification shall include batch test results for each product.
   5. Manufacturer’s representative’s written letter confirming Contractor’s employees are qualified for installation of products and trained through job site instruction conducted by manufacturer.

B. Manufacturer's Services: Prior to and at the beginning of installation, manufacturer's representative shall conduct job site training to proper installation, handling, and storage of each product delivered to project site, for personnel who will perform actual installation. A minimum of three (3) days notice shall be given by the Contractor, to the manufacturer, prior to these visits.

1.5 DELIVERY, STORAGE AND HANDLING

A. Insure storage facilities are weather tight and dry.

B. Do not use remnant portions of epoxy solids exposed to air or mixed beyond pot life.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Epoxy Grout Cartridges: Epoxy gel adhesive; high strength; creep resistant; two-component; insensitive to moisture; compatible for intended use and environmental conditions; prepackaged in cartridges for caulk guns and automatically mixed at nozzle. Epoxy shall have minimum Heat Deflection Temperature of 128 degrees F, ASTM D648, and shall be ICC approved.
   1. Approved epoxy grout systems are:
      a. HIT- RE 500 V3 by Hilti, Inc

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be drilled to verify conditions of access, interferences, and existing materials. Locate dowels 3" clear of existing reinforcement, metal ties, or mortar joints.

3.2 PREPARATION.

A. Protect existing exposed surfaces from grouting operations.

B. Dowels shall be free of oil, grease, mud, paint and loose rust or other materials that may reduce bond. Clean dowels by wire brushing or washing with petroleum solvents as required. Dowels shall be dry when placed

3.3 DRILLING

A. Holes to Receive Dowel and Epoxy:
   1. Drilling Equipment:
      a. Use electric rotary drill only.
   2. Hole diameter: Drill holes to a diameter 1/8 inch larger than the normal diameter of the dowel unless manufacturer's recommendations differ.

3. Embedment Depth: Install to depth shown on Drawings.

3.4 PLACEMENT

A. Holes to Receive Dowel and Epoxy with Screen Tubes:
   1. Clean hole by brushing with a nylon brush and by blowing out with oil-free high-pressure air jet.
   2. Select screen tube equal in length to the depth of the hole.
   3. Fill screen completely with epoxy outside hole, insert into hole, place thumb on screen tube tab, insert dowel slowly into epoxy filled screen, rotating dowel to remove air.

B. Holes to Receive Dowel and Epoxy without Screen Tubes:
   1. Clean hole by brushing with a nylon brush and blowing out with oil-free high-pressure air jet.
   2. Place a measured amount of epoxy into caulk gun equipped with an extension tube matching the depth of the hole. Place tube at bottom of hole and slowly withdraw as epoxy is evenly injected. Where hole depth is greater than 2 feet, place grout under pressure using gel pump.
   3. Insert dowel slowly to bottom of hole, rotating it to remove trapped air.
   4. Fill abandoned holes with epoxy and bar cut flush at surface.

3.5 CLEANING

A. Holes with Epoxy
   1. Clean excess epoxy from around holes before it hardens only on surfaces that will not be exposed to view.
   2. On surfaces that will be exposed to view, allow epoxy to cure then chip away hardened epoxy. Surfaces shall be repaired to match existing finish to the satisfaction of the Owner and Architect at no additional cost to the Owner.

3.6 QUALITY CONTROL

A. Inspection and Testing will be performed per chapter 17A and Section 1910A.5 of the California Building Code.

B. Special Inspector will:
   1. Review manufacturer’s recommended Special Inspection procedures.
   2. Periodically inspect drilling for conformance with Contract Documents and manufacturer’s recommendations.
   3. Certify in writing to the Engineer that depth and location of holes conform to requirements of Contract Documents prior to placement of epoxy.
   4. Continuously inspect placement of epoxy and dowel installation.

C. Testing Laboratory will provide a quality control testing program of the dowels.
   1. Test locations and frequency will be at Laboratory’s discretion, unless otherwise directed by the Engineer subject to the following minimum requirements:

a. When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.
b. When post-installed anchors are used for other structural applications, all such anchors shall be tested.
c. When post-installed anchors are used for nonstructural components, such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

2. The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.
3. There shall be no loosening or movement of dowel out of hole and no cracking or spalling concrete in which dowel or bolt is set.
4. If any anchor fails testing, all anchors of the same type installed by the same trade and not previously tested until twenty (20) consecutive anchors pass, then resume the initial frequency.

D. Contractor shall replace field dowels at the direction of the Engineer at no additional cost.

E. The school board shall pay for all tests/inspections, but if so specified the amount or a portion thereof may be collected from the contractor by the school board. When in the opinion of the architect or registered engineer, additional tests/inspections are required because of the manner in which the contractor executes his or her work, such tests/inspections shall be paid for by the schoolboard, but if so specified the amount paid may be collected from the contractor by the school board. Examples of such tests/inspection are: tests of material substituted for previously accepted materials, retests or re-inspections made necessary by the failure of material to comply with the requirements of the approved construction documents and specifications, and load tests necessary because certain portions of the structure have not fully met specification or plan requirements.

END OF SECTION 032600

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Mixing, delivering, placing and finishing of concrete for plain and reinforced slabs, walls, footings, columns, and miscellaneous areas.

2. Providing mix designs.

3. Concrete finishing and patching.

4. Curing compounds.

5. Saw cutting of existing concrete walls and slabs.

B. Related Work Specified Elsewhere:

1. Providing: Form work and form stripping.

2. Providing: Reinforcement; and accessories such as anchors, sleeves and inserts.

1.2 REFERENCES, CODES AND STANDARDS

A. The following references, codes and standards are hereby made a part of this Section and concrete work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

1. "Building Code Requirements for Reinforced Concrete," ACI 318, 2019 Edition.

2. California Building Code, 2022 edition, Chapter 19A.

3. "Standard Specifications", American Society for Testing and Materials. (ASTM)

1.3 SOURCE QUALITY CONTROL

A. Cement and Aggregates: Furnish to the Architect the following data:

1. Mill certificates from cement manufacturer certifying that cement meets Specifications and is suitable for purpose intended. Where low alkali cement is

required, certificates shall show compliance with ASTM C 114 latest edition.

2. Proof of aggregate's compatibility with cement to be used and certification that aggregates meet Specifications.

B. Owner reserves the right to have his testing agency perform any additional tests on cement and aggregates which may be deemed advisable.

1.4 ENVIRONMENTAL CONDITIONS

A. Cold Weather Requirements: Comply with ACI 306R latest edition, "Cold Weather Concreting."

B. Hot Weather Requirements: Comply with ACI 305R latest edition, "Hot Weather Concreting."

1.5 SHOP DRAWINGS

A. Submit complete mix designs to the Architect at least 7 days before first concrete pour. Mix designs shall include aggregate type and size, weights of each component, descriptions of all proposed admixture.

PART 2 - PRODUCTS

2.1 MATERIALS & EQUIPMENT

A. Portland cement: ASTM Standard Specification for Portland cement, C-150, latest edition. Type 2 - one brand of cement shall be used throughout the work.

B. Aggregates: ASTM C 33 and C 88 from sources with proven history of successful use. Source shall be constant unless 10 days' prior notice is given for approval after recheck of mix design.

1. Fine Aggregate: Felton Olympia sand or approved equal, equal product shall have the same or better shrinkage characteristics as Felton Olympia sand.

2. Coarse Aggregate: Coarse limestone or granite aggregate, from sources approved by Structural Engineer. The maximum size of coarse aggregate shall be not larger than any of the following:

- 1/5 the narrowest dimension between side of forms, nor
- 1/3 the depth of the slabs, nor
- 3/4 the minimum clear spacing between individual reinforcing bars or wires, bundles of bars , individual tendons, bundled tendons, or ducts.
- 1"

3. Gradation of combined aggregates shall be within the following limits:

Sieve Size	1 inch Max. Agg.	3/4 inch Max. Agg.
2inch	100	100
1-1/2inch	100	100
1inch	50-100	100
3/4inch	45-75	90-100
3/8inch	38-55	60-80
No.4	30-45	40-60
No.8	23-38	30-45
No.16	17-33	20-35
No.30	10-22	12-25
No.50	4-10	5-15
No.100	1-3	1-5
No.200	0-2	0-2
	(Percent passing sieve)	

C. Mixing water: potable, clean and free from injurious amounts of acid, alkali, or other harmful substance. Obtain water from local utility company mains unless another source is approved by the Engineer.

D. Air Entraining Admixtures - ASTM C260.

E. Water reducing, retarding and accelerating admixtures - ASTM C494.

F. Pozzolan, Fly ash, between 15-30% by total mass may be used. - ASTM C618.

G. Use mixes with air entrainment of 2-1/2 percent to 3-1/2 percent.

H. Curing compounds - ASTM C309 : Burke Super Bond Breaker, as manufactured by The Burke Company; Silcoseal 77 or equal.

I. Equipment: in good clean condition, and is subject to the approval of the Engineer, when used to mix, transport, place and finish concrete.

J. Non-shrink grout (Non-Metallic): The Burke Company "Non-Ferrous, Non-Shrink Grout"; Master Builders "Masterflow 928", or approved equal.

K. Patching and Sacking material shall consist of one part Portland cement, three parts clean dry No. 30 sand, and a sufficient amount of diluted PVA Bonding agent to form a workable mortar. Diluted PVA Bonding agent shall be Sealtight PVA or equal, diluted with an equal amount of clean water.

L. Vapor Barrier:

1. Water vapor transmission rate 0.01 grains per square feet per hr. when tested according to ASTM E1745 Section 7.1 (7.1.1-7.1.5). Provide Manufacturesr's recommended mastics and gusset tape.

2. Manufacturer: Stego Wrap Vapor Barrier by Stego Industries, LLC.

2.2 MIXES

A. For project specific concrete strengths and other requirements, refer to concrete general notes on sheet 2S0.1.

B. Concrete supplier shall be responsible for design of mixes to provide minimum requirements listed on the drawings. Increase cement content over that shown, if required to obtain compressive strength.

C. Proportion materials by weight.

D. Use admixtures only with prior approval of Engineer.

E. Calcium chloride, added to accelerate hardening, use only upon prior approval by Engineer. Dissolve in water before adding to the mix and add at the batch plant. Maximum permissible quantity shall be 2 percent by weight of the cement used.

F. Transit mix concrete in accord with ASTM C94, except that small batches of 1/2 cubic yard or less may be mixed on site. Mix concrete for not less than 10 minutes total, of which not less than three minutes shall be on the site just prior to pouring. Mix continually with no interruptions, from time truck is filled until it is emptied. Place concrete within one hour of time water is first added.

PART 3 – EXECUTION

3.1 MIXING

A. Concrete shall be ready mixed as per ASTM C 94. Equipment shall be adequate for the purpose and kept in good mechanical condition at all times.

B. The rate of delivery, haul time, mixing time and hopper capacity shall be such that mixed concrete delivered shall be placed in the forms within 90 minutes or 300 revolutions of the drum from the time of introduction of cement and water to the mixer. Any interruption in placing in excess of 90 minutes or 300 revolutions will be cause for shutdown of the work for the day and the wasting of any remaining mixed concrete in hoppers or mixers. In case such interruption occurs, the Contractor shall provide construction joints where and as directed and cut concrete back to such line, cleaning forms and reinforcing as herein specified. Delivery tickets shall show departure time

from plants. Revolution counters shall be set at "0" and shall commence to operate when drum revolution begins after introduction of ingredients into the mixer.

C. No water shall be added to the mix after the initial introduction of mixing water for the batch except when, on arrival at the job site, the slump of the concrete is less than that specified. In this case, additional water may be added from the truck system to bring the slump within required limits. The drum or blades shall then be turned an additional 30 revolutions or more until mix is uniform.

D. Mixers shall be equipped with an automatic device for recording number of revolutions of drum or blades prior to completion of mixing operation.

E. Concrete shall be kept continuously agitated until discharged into the hopper at the job site.

3.2 PLACING

A. Convey concrete from mixer to final location as rapidly as possible by methods preventing separation of ingredients. Deposit concrete as nearly as possible in final position to avoid rehandling.

B. Pump concrete into place optionally, in certain locations, on prior approval of Engineer. Submit re-design of mix to Engineer for approval when this procedure requires re-design.

C. Concrete at all flatwork shall be screeded off uniformly with approved screeds. Final troweling and finishing is covered under another section of these specifications.

D. Place no concrete at temperatures below 40 degrees F, unless a method approved by Engineer is used to heat both concrete materials and air surrounding concrete after placement. Maintain temperature of air next to the concrete at not less than 40 degrees F for the full curing period of 7 days.

E. Clean mixing, conveying and finishing equipment, forms and reinforcing well before placing concrete. Wet forms before placing concrete, unless oiled forms are used.

3.3 VIBRATION AND CONSOLIDATION

A. Concrete shall be thoroughly compacted by means of internal mechanical vibrators. Such consolidation shall be produced as will be obtained by placing the vibrator directly in concrete at 18" - 30" intervals for a period of approximately 5 to 15 seconds and withdrawing slowly or as directed, depending on the consistency of concrete. One vibrator will be required for each location where simultaneous placing takes place, to ensure thorough vibrating of all sections. Provide sufficient spare vibrators on the job so as to have them readily available in case any vibrator in use should suddenly cease to function properly. Where spare vibrators are employed, provide additional spares. Under no condition shall vibrator be placed against reinforcing steel or attached to forms. Use no vibrators to transport material.

B. Vibrator shall be of the flexible immersion type having a frequency of not less than 8,000 rpm.

C. Usage and types of vibrators shall conform to ACI 309, "Recommended Practice for Consolidation of Concrete."

3.4 CONSTRUCTION JOINTS

A. Placement of construction joints and the manner in which they are provided for shall be only as approved by Architect or as shown on the Drawings. Construction joints shall be as few as possible and will not be permitted simply to save forms. Submit shop drawings of construction joints showing proposed locations and details. Submit to Structural Engineer prior to forming or placing concrete.

B. Construction joints including keys shall be cleaned and roughened by removing entire surface and exposing clean aggregate solidly embedded by means of sandblasting or other approved methods. Forms and reinforcing shall be cleaned of drippings, debris, etc. Just before starting of new pour, horizontal surfaces shall be covered with 1/2" - 1" thickness of grout composed of cement and fine aggregate of the same proportion as that used in concrete work, but omitting the 1" aggregate where 1" is the maximum size, or 1/2 of the 3/4" aggregate where 3/4" is the maximum size. Alternately, a bonding agent may be applied to the joint surface.

3.5 CURING (FORMED CONCRETE)

A. Cure concrete slabs by means of compound applied in accord with manufacturer's instructions, except when different method of curing is called for.

B. Curing compound application:

1. Application shall commence immediately following completion of specified finishing.

2. When applying compound, the surfaces shall be damp but shall be free from standing water.

3. Surfaces shall be covered with a uniform and even film of compound, as supplied. Use pressurized spray equipment and apply in a single coat to achieve total coverage as recommended by manufacturer.

3.6 FIELD QUALITY CONTROL

A. Tests and inspections shall be performed by qualified individuals, engineering companies or testing laboratories who shall perform those special inspections required by Sec.

1705A.3 and Sec. 1910A of the California Building Code, those tests and inspections specified below and such other tests and inspections as the Architect or Owner may require to establish the acceptability of the work.

B. Testing and inspection services shall be retained by the Owner at his expense except that when tests or inspections reveal failure of materials to meet contract requirements, costs for subsequent tests and inspections will be deducted from the Contract Price. Excessive inspection time required by Contractor's failure to provide sufficient workmen or to properly pursue the progress of the work shall likewise be deducted from the Contract Price.

C. Furnish material and handling for test cylinders and any other samples which testing agency requires for analysis of concrete work.

D. Compression Tests: 4 compression test cylinders will be taken for each placement of 50 cu. yd. or 2000 square feet of surface area of slabs and walls or fraction thereof of each class of concrete placed each day except take 5 cylinders for post-tensioned concrete. Make, cure and store test cylinders as per ASTM C 31. One cylinder will be tested at 7 days for information; two at 28 days for acceptance; and one retained as a spare. For post-tensioned concrete, test one cylinder at 5 days to verify strength for tensioning. Cylinders will be numbered in sets (1A, 1B, 1C, 1D; 2A, 2B, 2C, 2D; etc.) and a record kept of extent of pour represented by each set and type of concrete tested. Cylinders will be tested in accord with ASTM C 39. If any test report indicates 28-day specimen below required strength level (within standard of acceptability established by ACI 318), and if required by Architect, testing agency will take test cores of hardened concrete in accord with ASTM C 42. Such concrete shown to be defective shall be removed and replaced. Cost of core tests, repairs and removal and replacement of defective concrete shall be paid by Contractor.

E. Slump Test: Slump tests will be performed as per ASTM C 143 (slump cone) at time of taking test cylinders.

F. Testing agencies will supervise preparation and selection of samples taken at job site.

G. The following is subject to Special Inspection as per Sec. 1705A.3 California Building Code. Costs therefore will be paid by the Owner.

1. Taking of compression test specimens as required by Sec. 1705A.3.

2. Placement of reinforced structural concrete as required by Sec. 1705A.3.

3. Bolts in concrete as required by Sec. 1705A.3.

END OF SECTION 033000

SECTION 033500 - CONCRETE FINISHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Finish required on exposed cast-in-place concrete surfaces including patching or repair of defective areas and all curing of cast-in-place concrete (except formed surfaces).

B. Related Work Specified Elsewhere:

1. Curing of formed concrete: See Concrete, Cast-In-Place.

2. Caulking and Sealants.

3. Painting (if required).

1.2 PROTECTION

A. Protect exposed surfaces including flat work as required to prevent damage by impact or stains.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Curing Materials:

1. Curing Paper: ASTM C 171 latest edition, non-staining waterproof paper, regular type.

2. Curing Compounds: ASTM C 309 latest edition, Type 1, clear resin type free of oil, wax, grease, or other substance which might prove deleterious to any material to be applied to concrete. Curing compounds for exposed slabs shall be a multi-purpose curing-hardener-sealer type equivalent to Sonneborn-Contech "Kure-N-Seal," L&H "Dress & Seal" or Protex "Triple Seal."

PART 3 - EXECUTION

3.1 CURING

A. Concrete shall be cured by curing paper or curing compounds.

B. Curing compounds shall not be used on surfaces when their use may be detrimental to bonding of concrete, caulking and sealants or the specified surface finish or coating. Curing-hardener-sealer type compounds shall be used for exposed slabs.

C. Curing Compound - General:

1. Application shall commence immediately following completion of specified finishing.

2. When applying compound, the surfaces shall be damp but shall be free from standing water.

3. Surfaces shall be covered with a uniform and even film of compound, as supplied. Using pressurized spray equipment, apply in a single coat to achieve total coverage as recommended by manufacturer.

4. When curing compound is applied inside enclosed spaces, adequate mechanical ventilation shall be provided and maintained throughout the periods of application.

D. Paper Curing: Concrete not otherwise permitted to be cured by curing compound shall be paper cured as follows:

1. Slabs shall be saturated such that free moisture occurs over the entire area.

2. After dampening, slabs shall be immediately covered with curing paper lapped 4 inches at joints and sealed with adhesive tape or waterproof glue. Curing paper shall remain in place for not less than 10 calendar days. During curing period, scuffed or torn areas shall be promptly recovered with additional papers. Do not use any curing papers which contain a distinct thread design that may leave an impressed pattern on the slab.

3.2 PATCHING AND REPAIR OF DEFECTIVE AREAS

A. Within 3 days after stripping formwork, surface defects such as rock pockets, honeycombs, cracks, and holes shall be filled and patched. The Architect shall distinguish between concrete which requires replacement or repair and surface defects which require patching. Permission to patch any area shall not be construed as a waiver of the Architect's right to require complete removal of the defective work if the patching, in his opinion, does not satisfactorily restore the quality and appearance of the surface.

B. Areas to be patched shall have loose material chipped away and shall be thoroughly dampened for at least 6 inches entirely surrounding the patch. Coat areas with thin brush coat of fine sand-cement grout followed by patching mortar. Patching mortar shall be prepared of the same material and proportions as used for concrete, except that coarse aggregate shall be removed. Where exposed concrete is to remain unpainted, trial

patches using combinations of white cement and cement used in concrete mix shall be allowed to set up in order to verify that the patching mortar shall match the color of the adjacent concrete surface. Water in the mix shall be kept to a minimum. Mortar shall not be retempered by adding water. Mortar shall be allowed to stand for one hour prior to use and shall be mixed to prevent setting. Mortar shall be compacted thoroughly into place and screeded to leave patch slightly higher than surrounding surfaces and then left undisturbed for 1 to 2 hours to permit initial shrinkage. Patch shall then be finished to match adjacent surfaces.

C. Form tie holes shall be patched and finished flush with adjacent surface.

3.3 FINISHES

A. Formed Exposed Surfaces: Remove fins and projections, patch depressions, coat with fine sand-cement (1-1/2:1) slurry and rub with rubber or cork float and clean burlap to provide a smooth surface uniform in overall color and appearance.

B. Flatwork:

1. Unless otherwise noted or specified, slabs shall be finished monolithically. Floor slabs which are indicated as sloped to floor drains shall be sloped uniformly so as to provide positive drainage of the indicated areas. Special care shall be taken that a smooth, even joint is obtained between successive pours.

2. Tolerances:

a. Exposed concrete slabs, epoxy coated slabs, and slabs to receive carpet: 1/8 inch in 8 feet with maximum high and low variance not occurring in less than 16 feet and with 1/16 inch tolerance in any one running foot with no abrupt variations.

b. Slabs to receive resilient flooring: 1/8 inch in 10 feet with maximum high and low variance not occurring in less than 20 feet, and with 1/16 inch tolerance in any one running foot with no abrupt variations.

C. Float Finish (Typical for slabs to receive thin-set tile): Place, consolidate, strike off and level concrete slab to proper elevation. After concrete has stiffened sufficiently to permit the operation and water sheen has disappeared, surface shall be floated at least twice to a uniform sandy texture.

D. Trowel Finish (Typical for exposed interior slabs and panels): After the concrete slab has been float finished, the surface shall be troweled at least twice as smooth, dense, uniform finish free of defects and blemishes. Jitterbugs shall not be used. No dry cement or mixture of dry cement and sand shall be sprinkled on the surface.

E. Broom Finish (Typical for exterior slabs, sidewalks and truck ramps): After the concrete has received a float finish, the surface shall be given a fine broom finish with a broom not less than 18 inches wide. The broom shall be pulled gently over the surface of the concrete from edge to edge. Adjacent strokes shall be slightly overlapped. Brooming

shall be so executed that the corrugations thus produced will be uniform in character and width and provide a non-slip finish. The broomed surface shall be free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near the surface.

3.4 DEFECTIVE WORK

A. Finish which is not true to line and plane, which is not in conformance with specified finish and appearance requirements, which exceeds specified tolerances, which does not properly connect to adjoining work, which does not slope to drain and which has been improperly cured, will be deemed as defective. Defective work shall be repaired or removed and replaced as directed by the Architect with proper work meeting Drawing and Specification requirements and at no added cost to the Owner.

END OF SECTION 033500

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
1. All structural steel and field connection material as defined in the AISC "Code of Standard Practice for Steel Building and Bridges," latest edition, including erection.
2. Materials for structural steel and field connections as defined in AISC.
3. All steel angles, plates, rolled shapes and fabricated connection pieces shown on the drawings for joining structural members, whether these members are wood, metal or concrete; except metal glulam connection material at hinge connections, wood column caps and wood column bases.
4. All bolts or anchor bolts connecting materials furnished under this section to wood, to concrete or to metal portions of the structure.
5. Angles, channels or flat bars, with anchors, where shown at door sills, jambs, dock edges, pits and similar edges.
6. Steel pipe as guards or bollards.
7. Metal handrails and guardrails.
8. Erection of all structural steel and miscellaneous iron.
9. All temporary bracing required to erect steel erected under this section.
10. Metal grating, except at exterior catch basins.
11. Shop painting of materials furnished under this section, where so indicated on the drawings.
12. Galvanizing of materials furnished under this section, where so indicated on drawings or specified below.
13. Welding of connections between reinforcing steel, where such connections include connection plates or angles, and all plates and angles required at such connections.

B. Related Work Specified Elsewhere:
1. Bolts, anchors, inserts connecting wood to wood or wood to concrete.
2. Light metal joist hangers, framing anchors and straps except where these are attached to steel members.
3. Finish field painting.
4. Miscellaneous metals.
5. Hollow metal doors and frames.

1.2 REFERENCES, CODES AND STANDARDS

A. The following references, codes and standards are hereby made a part of this Section and structural steel work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

1. “Load and Resistance Factor Design Specification for Structural Steel Buildings,” American Institute of Steel Construction, AISC 360-16.
2. "Standard Specifications", American Society for Testing and Materials (ASTM).
3. "Structural Welding Code, AWS D1.1", American Welding Society (AWS).
4. "Standard Specifications for welding electrodes", A-5 Series, AWS.
5. Federal Specifications, General Services Administration, U.S. Government.
6. "Steel Structures Painting Manual, Volume 2", Steel Structures Painting Council.
7. California Building Code, 2022 Edition, including local amendments.
8. ASTM 6 “Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
9. Safety regulations prescribed by OSHA.

1.3 QUALIFICATIONS

A. Welding procedures, welders and tackers shall be qualified in accord with AWS Code.

1.4 DEFINITIONS

A. Building Official
   1. The term Building Official is applied to the regulatory agency having jurisdiction of the building.

B. Contractor
   1. The Contractor is the firm performing the fabrication or erection of the structural steel framework. The Contractor may be the still fabricator responsible for the shop fabrication of the structural steel, and/or the steel erector, responsible for all field erection and field welding.

C. Contract Documents
   1. The Contract Documents include the design drawings, including schedules, notes and details, the project specifications, and the Quality Assurance Plan.

D. Engineer
   1. The Engineer is the registered design professional in responsible charge of the design of the structural steel framing system.

E. Heavy Structural Sections
   1. The following rolled sections and built-up sections shall be considered as Heavy Sections, subject to special notch toughness, fabrication, welding and inspection requirements as specified herein.
      a. ASTM A6 Group 3 shapes with flanges thicker that 1-1/2 in.
      a. ASTM A6 group 4 and Group 5 shapes
      b. Welded built-up members with web or flange plates exceeding 2 inches in thickness.

F. Hold Point
   1. A stage in the work beyond which the work shall not proceed until the designated inspector has completed specified inspection tasks.

G. Nondestructive Testing
   1. Nondestructive testing (NDT) includes magnetic particle testing (MT), penetrant testing (PT), radiographic testing (RT), and ultrasonic testing (UT). The terms nondestructive examination (NDE) and nondestructive testing (NDT) are synonymous.

H. Observation Point
   1. A stage in the work beyond which the work may proceed after the workman has completed his or her own inspection, with special inspection provided by the designated special inspector through observation of the work operations on a routine, occasional, random basis.

I. Owner
   1. The Owner is the entity responsible for providing Quality Assurance.

J. Quality Assurance
   1. Quality Assurance (QA) consists of those inspection and testing services to be performed by an agency or firm other than the contractor to ensure that the material and the workmanship of structural steel construction meet the project specifications, applicable standards, and the Quality Assurance plan.

K. Quality Assurance Agency
   1. The Quality Assurance (QA) Agency is the independent testing organization selected by the Owner, or Owner's designee, to perform the Quality Assurance inspection and testing required by the Quality Assurance Plan, specifications and contract documents.

L. Quality Assurance Plan
   1. The Quality Assurance Plan ("Plan") is the written requirements containing the set of procedures that are to be followed to confirm compliance with these requirements. The Quality Assurance Plan shall be part of the Contract Documents.

M. Quality Control
   1. Quality Control includes those functions to be performed by the contractor to ensure that the material and workmanship for structural steel construction meet the project specifications, applicable standards, and the Quality Assurance Plan.

N. Quality Control Plan
   1. The Quality Control (QC) Plan is the written statement, prepared by the Contractor, of all measures that will be taken to ensure that construction conforms to the applicable standards, project specifications, and the Quality Assurance Plan.

O. Special Inspection
   1. Special Inspection is a Quality Assurance activity comprising inspection of the installation, fabrication, erection or placement of components and connections requiring special expertise to ensure adequacy.

P. Special Inspector

1. The Special Inspector is the individual or firm employed by the Owner, to provide the special inspection required. In most cases, the Special Inspector and the Quality Assurance Agency are the same entity.

Q. Seismic-Force-Resisting System
   1. The Seismic-Force-Resisting System (SFRS) is defined as the assembly of structural elements in the building that resists seismic forces. Included in the SFRS are the columns, beams, girders and braces, and the connections between these elements, specifically designed to resist seismic forces, as designated on the contract documents. The SFRS does not include members that provide out-of-plane bracing to components of the SFRS, nor does it include other structural members designed to resist only gravity loads.

R. Structural Observation
   1. Structural Observation is the visual observation of the structural systems by a registered design professional, for general conformance to the approved construction documents, at significant construction stages and at completion of the structural system.

S. Structural Steel Framing
   1. Structural steel framing shall be as defined in the AISC Code of Standard Practice, Section 2.1.

T. Written Practice
   1. The Written Practice is the Quality Assurance Agency's procedures for determining and ensuring the acceptability of the structure in accordance with the applicable codes, standards, specifications, and procedures, including general inspection, material controls, visual welding inspection and bolting inspection. The Written Practice also describes the selection and administration of inspection personnel, and the training, experience and examination requirements for qualification and certification of inspection personnel.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   1. Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
      a. Submit to the Owner's testing and inspecting agency data on structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
      b. Structural steel primer paint, if used.
      d. Shrinkage- resistant grout.

B. Shop Drawings

1. Shop drawings prepared under supervision of a licensed Civil or Structural Engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
2. The Contractor shall submit to the Engineer detailed, coordinated and checked shop drawings for all structural steel for review prior to the start of fabrication and/or erection. Shop drawings shall show:
   a. size and location of all structural members and connection material,
   b. complete information necessary for the fabrication of members including cuts, copes, holes, doubler plates, stiffeners, and camber,
   c. type, size and location of bolts and welds,
   d. surface preparation and finishes,
   e. details of assembly,
   f. identification of Welding Procedure Specification (WPS) applicable to each shop weld.
   g. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorage to be installed as work of sections.
   h. Welding Procedures: All methods, sequence, qualifications and procedures, including preheating shall be detailed in writing and submitted for review. Welded joints shown on the Drawings or required for fabrication and erection, which are not designated as pre-qualified in the AWS Code, are subject to all applicable AWS Code provisions and shall be qualified by test in accordance with Section 4 of the AWS Code.
3. Test reports conducted on shop-and field bolted and welded connections. Include data on type(s) of test conducted and test results.
4. Welded connections shall be identified using standard AWS symbols as given in AWS A2.4, Standard Symbols for Welding, Brazing and Nondestructive Testing, and shall clearly distinguish between shop and field welds.

C. Erection Drawings
   1. The Contractor shall submit to the Engineer detailed, coordinated and checked erection drawings for all structural steel for review prior to the start of fabrication and/or erection. Erection drawings shall be submitted that show:
      a. location of all structural material,
      c. identification mark of members,
      d. orientation and relation of members to appropriate grid lines,
      e. setting elevations for column bases,
      f. standard and special details for bolted and welded field connections,
      g. identification of WPS applicable to each field weld.

   2. Welded connections shall be identified using standard AWS symbols as given in AWS A2.4, Standard Symbols for Welding, Bracing and Nondestructive Testing, and shall clearly identify field welds.

D. Erection Plans
   1. Prior to starting erection, the Contractor shall submit to the Engineer, for record purposes, a description of the methods, scheme of erection, sequence of erection, and type of equipment proposed for use in erecting the structural steel work. Included shall be design information, plans and elevations showing proposed temporary bracing and shoring systems, with the magnitudes, locations and directionality of

construction loads imposed on the permanent structure. The Engineer will have no responsibility to review this submittal nor to approve of the Contractors means and methods.

2. The steel erector shall also submit for record purposes, written procedures indicating field welding sequences for each type of welded moment connection, and field welding sequences for moment connections at each level. The Engineer will have no responsibility to review this submittal nor to approve of the Contractors means and methods.

E. Contractor's Statement of Responsibility
   1. Each Contractor responsible for the work shall submit a written Statement of Responsibility to the Owner and Building Official prior to commencement of the work. The statement shall contain the following:
      a. acknowledgment of awareness of the special requirements contained in the Quality Assurance Plan,
      b. acknowledgment that control will be exercised to obtain conformance with the construction documents,
      c. procedures for existing control within the Contractor's organization, the method and frequency of reporting, and the distribution of reports, and
      d. identification and qualifications of the persons exercising such control and their positions in the organization.

F. Certificates of Compliance
   1. Coincident with the submittal of manufacturer's test reports and certifications for structural steel, fasteners, welding filler metals, and shear studs, the Contractor shall submit a letter stating that the Contractor has reviewed the submitted manufacturer's certifications and test reports, and that the materials being furnished for the project are in conformance with the applicable standards, specifications and project documents.

G. Manufacturer's Test Reports
   1. Structural Steel
      a. The fabricator shall submit, for record, copies of material test reports, commonly called mill test reports, for all structural steel in the Seismic-Force-Resisting System. Material test reports shall comply with the requirements of ASTM A6. Material test reports shall be accompanied by a Certificate of Compliance from the fabricator.
   2. Fastening Material
      a. The Contractor supplying fastener products shall submit, for record, copies of all Manufacturer's Certifications for all fastener components, including bolts, nuts, washers, and direct tension indicators, if used in a Seismic-Force-Resisting System. Fastener Manufacturer's Certifications shall be accompanied by a Certificate of Compliance from the Contractor.
      b. Manufacturer certifications for bolts shall contain at least the following information:
         i) heat analysis, heat number, and a statement certifying that heats having prohibited elements intentionally added were not used to produce the bolts,
         ii) results of hardness, tensile, and proof load test, as required and performed,

iii) if galvanized, the results of rotational capacity tests, including the test method used (solid plate or tension measuring device) and the lubricant present,
iv) if galvanized, measured zinc coating weight or thickness,
v) results of visual inspection for bursts,
vi) statement of compliance with dimensional and thread fit requirements,
vii) lot number and purchase order number,
viii) complete mailing address of responsible party, and
viiii) title and signature of the individual assigned certification responsibility by the company officers.

3. Welding Material
   a. The Contractor supplying welding filler metal and shielding gas products shall submit copies of all Manufacturer's Certifications for all electrodes, fluxes and shielding gasses to be used. Certifications shall satisfy the applicable AWS A5 requirements. The welding material's Manufacturer's Certifications shall be accompanied by a Certificate of Compliance from the Contractor supplying the materials.
   b. The Contractor shall also submit the applicable manufacturer's supplemental certifications that the product meets any additional requirements of the project beyond that required by standard AWS A5 specification. Should the welding material manufacturer not supply such supplemental certifications as required, the Contractor shall have the necessary testing performed and provide the applicable test reports.
4. Shear Connectors (Shear Studs)
   a. The Contractor shall submit the following items:
      i) stud manufacturer's Manufacturer's Certification that the studs, as supplied, meet the requirements of AWS D1.1, Sections 7.2 and 7.3,
      ii) certified copies of the stud manufacturer's test reports covering the last completed set of in-plant quality control mechanical tests for the diameter supplied, and
      iii) certified material test reports from the steel supplier indicating diameter, chemical properties and grade on each heat number supplied.
   b. The stud manufacturer's Manufacturer's Certification shall be accompanied by a Certificate of Compliance from the Contractor.

H. Procedures
   1. Procedures shall assign responsibility to a person or position in the organization and shall contain enough detail to be useful to the workforce without reference to governing specifications. The procedures need not act as work instructions. Procedures shall be dated and indicate the person or position that has the authority to maintain the procedure.
   2. Fastener Installation Procedures
      a. The Contractor shall submit written procedures for the pre-installation testing, installation snugging, pretensioning, and post-installation inspection of fasteners. The procedures shall meet all requirements of the Research Council on Structural Connections (RCSC) Specification and the project documents. Procedures need to be submitted only for the methods of installation to be used by the Contractor,

which may include the turn-of-nut, calibrated wrench, twist-off type tension control bolt, and direct tension indicator methods.

3. Welding Procedure Specifications (WPSs)
   a. The Contractor shall submit all Welding Procedure Specifications (WPSs) to be used by the contractor on the project. For WPSs that are not prequalified per AWS D1.1, the supporting Procedure Qualification Record (PQR) shall also be submitted with the WPS. The Contractor shall also submit the manufacturer's product data sheets for all welding material to be used. The data sheets shall describe the product, limitations of use, recommended welding parameters, and storage and exposure requirements, including baking and rebaking, if applicable.
   b. Welding Procedure Specifications (WPSs) shall be categorized by and specify the following items:
      i) steel specifications and grades to be welded,
      ii) thickness range of material to be joined,
      iii) type of joint,
      iv) type of weld (groove, fillet, plug, slot),
      v) size of weld, and
      vi) position of welding.
   c. Based upon the application, the WPS shall specify, as a minimum, the following items, as applicable for the welding process:
      i) power supply (constant current or constant voltage)
      ii) welding electrode, flux, and shielding gas classifications,
      iii) welding electrode and flux manufacturer and trade name,
      iv) electrode diameter,
      v) voltage (except for shielded metal arc welding),
      vi) current (amperage) or wire feed speed,
      vii) electrical stick-out or contract tube-to-work distance (wire fed),
      viii) travel speed,
      viiii) minimum preheat and interpass temperatures,
      x) maximum preheat and interpass temperatures (if applicable),
      xi) number and placement of passes,
      xii) technique (stringer or weave bead),
      xiii) shielding gas flow rate,
      xiv) for groove welds, the joint configuration and tolerances, and
      xv) other pertinent information specific to the weld to be made.
   d. Tolerances, or the acceptable range of values, applicable to the various welding parameters shall also be noted in the WPS.
4. Welding Performance Qualification Records (WPQRs)
   a. The Contractor shall submit written Welding Performance Qualification Records (WPQRs) for all welding personnel under the Contractor's supervision who will be performing services on the project. The WPQR shall document the successful completion of the appropriate welding personnel qualification test. All welder qualification testing shall be performed in accordance with the current or a previous version of AWS D1.1. The Contractor shall also submit additional documentation that the welder has passed all designated supplemental welder qualification testing required for the types of welding to be performed.
   b. Should the WPQR testing have been performed more than six months prior to the start of the welding by the welder, documentation shall also be submitted showing that the welder has continued to use the applicable welding process on

an ongoing basis since the test was conducted, with no lapse in service exceeding six months.

c. The Welding Performance Qualification Records shall, as a minimum, provide the following information:
   i) welding process,
   ii) type of weld,
   iii) welding position,
   iv) thickness of test plate,
   v) thickness and nominal diameter of tubular test piece, if applicable,
   vi) if vertical position, whether upward or downward progression,
   vii) electrode group (F-number) classification (if SMAW),
   viii) test results,
   viiii) signature of Contractor's individual responsible for the test, and
   x) date of test.

5. Inspector Qualifications
   a. The Contractor shall submit written qualifications for all inspectors to be assigned Quality Control functions for the structural steel work, including general inspection, bolting inspection, welding inspection, and nondestructive testing.
6. Contractor's Quality Control Plan
   a. The Contractor shall submit the contractor's written Quality Control Plan, including any required modifications to satisfy the requirements for the project, and the Quality Assurance Plan.
7. Samples
   a. Material samples shall be provided as requested by the Engineer or Quality Assurance Agency. Routine physical verification of structural steel, fastener, or welding material composition or mechanical properties is not required.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver anchor bolts and other anchorage devices which are to be embedded in the work of other trades to the project site in sufficient time to permit their timely installation. Provide proper setting drawings, templates and directions for installation of these items.

B. Structural steel members which are stored at the site or a staging area shall be above ground on platforms, skids or other supports. Store fasteners and welding electrodes in a weathertight and dry place until ready for use. Store packaged materials in their original containers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be new and in perfect condition.

B. Paint: Rust inhibitive shop coat per Federal Spec. TT-P-86. Type III, TT-P-645, TT-P-664a, TT-P-636, or Steel Structures Painting Council Specification 15-68T. Do not use on steel to receive fireproofing.

C. Shop Paint Primer: SSPC PS 2.03-64T or F.S. TT-P-86, Type II.

D. Welding electrodes: Per AWS standards for the type of base metal and the welding process used. For field metal-arc welds, E70XX at A-36 steel, E70XX at A242, A441, A572 steel, grades 42 through 60. Obtain Engineer's approval of electrodes at higher strength steels or a full penetration welds. Any group (fast-freeze, fast-fill, fill-freeze or low hydrogen) may be used, depending upon the weld position, except that low hydrogen group, EXX18 or EXX28 shall be used where structural metals are welded to concrete reinforcing steel or at full penetration welds. Filler metal shall conform to AWS D1.1 and recommendations by their manufactures for position and other conditions of actual use.

E. Structural Steel Shapes, Plates: ASTM A 36 and Grade 50, ASTM A992.
   1. A36 – Specification for Carbon Structural Steel
   2. A992 – Standard Specification for Steel for Structural Shapes for Use in Building Framing

F. Cold-Formed Steel Tubing: ASTM A 500, Grade C.

G. Steel Pipe: ASTM A 53, Type E or S, Grade B.
   1. Finish: Black, except where indicated to be galvanized.
   2. Steel Castings: ASTM A27, Grade 65-35, medium-strength carbon steel.

H. Machine Bolts and Nuts:
   1. Bolts: ASTM A307, Grade A.
   2. Nuts: ASTM A563, Grade A.

I. Plain Washers: ANSI B.27.2, Type A.

J. Beveled Washers: ANSI B.27.4

K. Hardened Washers: ASTM F436

L. Headed Stud-Type Shear Connectors: AWS D1.1 “Type B” headed studs made from ASTM A108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with AWS D1.1 for the type and sizes shown.

M. F1554 – Specification for Anchor Bolts, Steel, 36 ksi Yield Strength

N. Anchor Bolts: ASTM A 307, ASTM A325 and ASTM A354 BD as indicated.

O. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low-carbon steel bolts and nuts.
   1. Provide hexagonal heads and nuts for all connections.

P. Welding Material
   1. Welding materials shall conform to the following AWS specifications, as applicable:
      a. ANSI/AWS A5.1-91, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
      b. ANSI/AWS A5.5-96, Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
      c. ANSI/AWS A5.17/A5.17M-97, Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
      d. ANSI/AWS A5.18-93, Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding
      e. ANSI/AWS A5.20-95, Specification for Carbon Steel Electrodes for Flux-Cored Arc Welding
      f. ANSI/AWS A5.23/A5.23M-97, Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
      g. ANSI/AWS A5.25/A5.25M-97, Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag Welding
      h. ANSI/AWS A5.26/A5.26M-97, Specification for Carbon and Low-Alloy Steel Electrodes for Electrogas Welding
      i. ANSI/AWS A5.28-96, Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding
      j. ANSI/AWS A5.29-98, Specification for Low-Alloy Steel Electrodes for Flux-Cored Arc Welding
      k. ANSI/AWS A5.32/A5.32M-97, Specification for Welding Shielding Gases

Q. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

R. Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, non corrosive, nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107. Grout shall attain a minimum compressive strength of 3,000 psi at 28 days.
   1. Products: Subject to compliance with requirements, provide one of the following:
      Euco N.S.; Euclid Chemical Co.
      Crystex; L & M Construction Chemicals, Inc.
      Masterflow 928; Master Builders.
      Sealtight 588 Grout; W.R. Meadows.

S. All galvanizing shall be in accordance with Fed. Spec. QQ-5-77a, Type 2, Class D, 1.25 ounce per square foot.

T. Attachments for metal roofing and siding shall be as follows:
   1. All attachments to be as manufactured by Construction Fasteners, Inc., or approved equal. All fasteners to have dished bonded metal backed neoprene washers. All metal parts of fasteners to be plated steel with CFI Silver Sentri Long-Life finish.
   2. Side laps: No. 14 x 7/8 inch self-drilling screws.
   3. Attachments to metal supports 3/16 inch or less in thickness: No. 14 x 1 inch or 1/4 inch x 1 inch self-drilling.

4. Attachments to metal supports thicker than 3/16 inch: 1/4 inch x 1 inch Type B screws in pre-drilled holes.
5. Attachments to wood supports: No. 10 x 2 inch woodgrip screws.
6. Neoprene closures required at metal roof decking and siding shall be factory-formed to fit the deck configuration.
7. All caulking and sealants used at metal roof decking and metal siding shall be a two component polysulfide liquid polymer, Fed. Spec. TT-S-00227E(2). PRC Rubber-Caulk, Dap Flexiseal, W.R. Grace, Hornflex, Presstite, or equal.

2.2 FABRICATION

A. General
1. Structural steel shall be shop fabricated in accordance with the applicable AISC Specification, AISC Code of Standard Practice, and AWS D1.1, as modified by the provisions of the contract documents.
2. High-strength structural steel shall be identified according to grade.
3. Members shall be marked and match-marked as needed for field assembly. Members shall be fabricated for delivery in a sequence that will expedite erection and minimize field handling of structural steel.
4. Cuts, holes, and openings in structural steel members, shown on the design drawings, shall also be shown on the shop drawings for structural steel and shall be done in the shop.
5. The Contractor shall cooperate fully with the requests from inspection and testing personnel for access to the connections and joints to be inspected or tested. This includes beam and column turning in the shop, weld backing removal when nondestructive examination indicates rejectable conditions, and access to platforms or scaffolding as required to perform the work safely. Weld backing removal shall also be performed where required by the Contract Documents. When weld backing must be removed for the test verification, the inspection must be performed in a timely manner so as not to hinder production nor require duplication of effort.
6. The Contractor shall conduct all necessary corrections of deficiencies in material and workmanship. Repair procedures shall be submitted to the Engineer for review and acceptance. The Contractor shall comply with requests to correct deficiencies, when such corrections are required by the Engineer or other designated responsible party. The Quality Assurance Inspector and NDT Technician shall be apprised of any repairs made by the Contractor.

B. Bolted Construction
1. Standard holes shall be used, unless otherwise indicated on the Drawings. Holes shall be drilled or punched at right angles to the surface of the metal, not more than 1/16 inch larger than the fastener diameter, except where oversize holes are specified. Making or enlarging holes by burning is prohibited, unless hole slotting is required between two punched or drilled holes. Center piercing with a torch and reaming to the required diameter is permitted. Material having a thickness in excess of the connector diameter plus 1/8 inch shall be drilled rather than punched. Burrs that would prohibit solid seating of the connected parts shall be removed.
2. Connections shall be assembled in accordance with the RCSC Specification, using provisions for pretensioned joints, unless snug-tight bolts are indicated on the Drawings. Faying surfaces of pretensioned joints shall be prepared as for Class A or better slip-critical joints unless otherwise indicated on the Drawings.

C. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
   1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
   2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

D. Architecturally Exposed Steel (A.E.S.) - Fabrication Tolerances:
   1. All members exposed to view in the completed structure shall be classified as "Architecturally Exposed Steel" (A.E.S.)
   2. Comply with the requirements of AISC, Code of Standard Practice for Steel Buildings and Bridges.
      a. Abutting cross sectional configurations shall match.
      b. Remove backing bars.
      c. Remove weld runoff tabs and grind smooth.
      d. Treat all surfaces and welds exposed to view as finished surfaces.
   3. Provide strict quality control over fabrication to assure fabrication and assembly for +/- ¼" tolerance from locations indicated in Contract Documents.
   4. Standard tolerances for structural steel shall not be acceptable.
   5. Where +/- ¼" tolerances are not possible, inform Architect of reasons prior to fabrication and provide options for methods for limiting variances. Where not otherwise informed prior to fabrication, +/- ¼" tolerances shall be required.
   6. Prior to fabrication, straighten material by methods which do not injure material.
   7. Prior to assembling component parts of connection, thoroughly clean contact surfaces of loose scale, rust and burrs and remove local twists and bends.
   8. Exposed Welds:
      a. Make exposed fillet welds smooth to uniform convex contour, radius and dimension for their full length. Grind welds smooth if not made to meet this criteria.
      b. Mill or grind all other exposed welds smooth and flush with surfaces of the adjoining materials welded.
   9. Weld show-throughs are not permitted.
   10. Remove weld splatter on architecturally exposed steel.
   11. Welds shall be designed for flush, smooth finish.
      a. Minor imperfections will be allowed only where practical to hide during primer application (epoxy filler).
      b. Defects which would be visible in the finished work shall be ground out, filled with welding material, and ground flush prior to finishing.
      c. Grind welds smooth where indicated. Typical AESS welds shall be neat, complete and free of voids, flush finish, not ground.
   12. Ensure exposed corners are square and sharp, and eased to radius of ¼ inch
   13. Provide holes required for other Work secured to or passing though architecturally exposed structural steel in accordance with final shop drawings.

E. Welded Construction:

1. Each welder working on the project shall be assigned an identification symbol or mark. Each welder shall mark or stamp this identification symbol at each weldment completed. Stamps, if used, shall be the low-stress type.
2. Welding personnel shall be qualified in accordance with AWS D1.1, Section 4, Parts A and C. WPQR testing performed more than six months prior to the start of the welding by the welder is acceptable, provided written documentation is submitted showing that the welder has continued to use the applicable welding process on an ongoing basis since the test was conducted, with no lapse in service exceeding six months. Welders whose work routinely exhibits poor workmanship shall be requalified before performing further welding.
3. WPSs shall be available to welders and inspectors prior to and during the welding process. Prior to welding, joint fit-up shall be verified by the welder for conformance with the WPS and AWS D1.1.
4. For all complete joint penetration (CJP) and partial joint penetration (PJP) groove welds subjected to ultrasonic testing (UT), a visible mark, “for UT,” shall be accurately placed on the steel a distance of 4 inches away from the root of the edge preparation.
5. Welding shall be performed in accordance with the appropriate WPS for the joint.
6. Groove welds shall be complete joint penetration groove welds, unless specifically designated otherwise on the Drawings. Groove preparation details are at the Contractor’s selection, subject to qualification, if required, in accordance with AWS D1.1.
7. Weld tabs shall be in accordance with AWS D1.1, Section 5.31, as modified by section 3.3B of this specification where applicable. End dams shall not be used.
8. Backing bars shall be in accordance with AWS D1.1, Section 5.10, as modified by Section 3.3A of this specification where applicable.
6. Faces of fillet and groove welds exposed to view shall have as-welded surfaces that are reasonably smooth and uniform. No finishing or grinding shall be required, except where clearance or fit of other items may so necessitate, or as preparation for coating.
7. Conform to "Standard Code for Welding in Building Construction" of the American Welding Society.". All welding except tack welds, shall be done by welders qualified by test, as prescribed in the "Standard Qualification Procedure" of the AWS (A5-1 or A5.5, etc.)
8. Surfaces to be welded shall be free of scale, slag, grease, paint and all other foreign materials. Parts shall be rigidly clamped while welding. Finished welds shall be of the size indicated on the drawings or when not shown, shall be of a size sufficient to insure adequate strength. Welds at pipe railings and other locations requiring smooth surfaces shall be ground smooth.
9. Where butt welds are shown connecting bolts to flat surfaces, bolt shall be ground to a 45 degree bevel (chisel point), weld shall be full penetration. Nelson studs of the same dimensions may be used in place of such anchor bolts if desired.
10. All welds at handrails and other items furnished under this section and so indicated on the drawings shall be ground smooth.
11. No welding shall be performed with T-4 electrodes.

F. Assemble and weld built-up sections by methods that will produce true alignment of axes without warp.

G. Shear studs:

1. Shear studs shall be welded in accordance with AWS D1.1, Section 7, and the manufacturer's recommendations. Shear studs shall not be attached in the area designated in Section 3.4E of this specification.
2. Prepare steel surfaces as recommended by manufacturer of shear studs. Weld shear studs in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear studs in accordance with manufacturer's printed instructions.

H. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings. Holes must be approved by the Engineer.

I. Provide threaded nuts welded to framing and other specialty items as indicted to receive other work.

J. Cut drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by busing, drill holes in bearing plates.

K. Fabricate metal gates to the dimensions shown on the drawings. Provide all required hinges and hardware. Provide sag rods and braces as required.

2.3 SHOP PAINTING

A. General: Shop-paint structural steel to be exposed to weather, except these members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.
1. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.
2. Do not paint surfaces scheduled to receive sprayed-on fireproofing.

B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
1. Concealed by finish surfaces other than paint.. SP-6 "Commercial Blast Cleaning."

C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use acting methods that result in full coverage of joints, comers, edges, and ex-posed surfaces. Apply finish coat in accordance with manufacturers instructions.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES

A. Before starting work, verify locations and elevations of bearings and anchor bolts. Immediately report inaccuracies. Work under this Section shall include responsibility for accurate bearing of steel and correct location of anchorage.

3.2 ERECTION

A. Structural steel shall be erected in accordance with the AISC Specification and the AISC Code of Standard Practice, as modified by the project documents.

B. Where erection requires performing fabrication work on site, the work shall conform to the applicable standards of Section 2.2, Fabrication.

C. The Contractor shall cooperate fully with requests from inspection and testing personnel for access to the connections and joints to be inspected or tested. This includes weld backing removal when non-destructive testing indicates rejectable conditions, and access to platforms or scaffolding as required to perform the work safely. When such services are required, the inspection must be performed in a timely manner so as not to hinder production nor require duplication of effort.

D. The Contractor shall perform all necessary corrections of deficiencies in material and workmanship. The Contractor shall comply with requests to correct deficiencies, when such corrections are required by the Engineer or other designated responsible party. The Quality Assurance Inspector and NDT Technician should be apprised of any repairs to be made by the Contractor, prior to performance.

E. Structural steel shall be stored and handled in a manner that prevents damage or distortion. Do not store materials on the structure in a manner that might cause distortion or damage to members of the supporting structure. Store materials to permit easy access for inspection and identification. Keep steel members off the ground by using blocking, cribbing, platforms, or other supports.

F. Where drawings call for threaded rods or bolts to be set in epoxy in existing concrete, drill the hole to the size indicated on the drawings, clean thoroughly with compressed air, set the rod in the specified epoxy. Follow strictly the epoxy manufacturer's specifications for preparation and use of the epoxy used. Protect the anchors from vibration or disturbance until the epoxy has cured.

G. Surveys: Employ a licensed land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Architect.

H. Temporary Shoring and Bracing
   1. Contractor’s erection scheme and temporary bracing and shoring shall provide lateral support and stability for all columns until permanent lateral-support systems (for example: wind bracing bents and horizontal deck/slab diaphragms) are in place and complete. Provide temporary shoring and bracing members in vertical and horizontal planes as required, with connections of sufficient strength to bear the imposed loads.

Remove temporary members and connections when permanent support systems are in place and final connections are made.

2. Erection Procedures
   a. The Contractor shall be responsible for the control of all erection procedures and sequences including but not limited to temperature differentials and weld shrinkage.
3. Field Work for Other Trades
   a. There shall be no field cutting of structural steel members in the Seismic-Force-Resisting System for the work of other trades without written prior approval of the Engineer.
4. Bolted Construction
   a. Fasteners shall be stored in a protected place. Except for ASTM F1852 “twist-off” type assemblies, clean and relubricate bolts, nuts and washers that become dry or rusty before use F1852 fastener components may be relubricated following the manufacturer’s written instructions, and must be retested after relubrication and prior to use to verify suitability for installation.
   b. Do not use flame cutting to align bolt holes except as permitted by RCSC specifications.
   c. Ream holes that must be enlarged to admit bolts. Do not enlarge holes by more than 1/32 in. Additional reaming beyond 1/32 in. shall not be performed without approval of Engineer. When reaming beyond 1/32 in. is approved, drill or ream to the next larger hole size and use the next larger bolt.
   d. Bolt holes may be made by punching or drilling. Bolt holes may also be made by thermal cutting to a smaller diameter, followed by reaming to the required diameter.
5. Welded Construction
   a. See Section 2.2F.
6. Shear Studs
   a. See Section 2.2H.
7. Corrective Work
   a. There shall be no field cutting or alteration of structural steel members or connections in the Seismic-Force-Resisting System without prior review by the Engineer. Structural elements having fabrication errors or which do not satisfy tolerance limits shall be repaired. Submit drawings showing reasons for, and details of, proposed corrective work for approval by the Engineer prior to performing corrective work. Corrective work shall be performed in accordance with the requirements of the Contract Documents. Pre-approved repair and correction procedures may be used when authorized by the Engineer for specific conditions.
8. Thermal Cutting
   a. Thermal cutting torches may be used in the field for correcting fabrication errors in structural framing only with the approval of the Engineer. When thermal cutting is permitted, cutting shall be done only with a mechanically guided torch or a torch controlled using a guide bar, except as permitted below:
      i) Thermal–cut edges that are not welded and will be free of substantial stresses, as determined by the Engineer, may be cut manually with an unguided torch provided the specified AISC edge distances to holes are maintained.

ii) Other thermal-cut edges and edges to be welded may be cut manually with an unguided torch to a line within 1/8 in. of the finished dimension, with final removal of material completed by chipping or grinding to produce a surface quality equal to that of the base metal edges.

b. Cuts shall be smooth and regular in contour, and free of notches. The radius of reentrant corners shall be no less than one-half inch. Cuts performed to modify beam copes may be made with a small radius, but shall not be cut square.

J. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work. Metal decking may be used as safety planking. Cooperate with metal decking contractor as required. Replace any metal decking damaged by its use as a working platform at no additional cost to owner.

K. Tolerances for AESS:
1. Erect structural steel in accordance with AISC standards. Tolerances shall be as listed in these publications, with the additional requirement for Architecturally Exposed Structural Steel that no defects in lines or levels be visible from a distance of 10 feet. Erected steel appearance shall conform to standards of approved visual mock-up.
2. Ensure steel is plumb, level, and in accurate alignment before making (mal connections.
3. Tolerances for Architecturally Exposed Structural Steel:
   a. Plumb/Level shall be +/- L/600 or ½". per floor, non-cumulative.
   b. Out of Parallel to Grid, Non-cumulative: ½".
   c. Up or Down in 25 feet: ½".
4. Where erection requires performing work of fabrication on site, conform to applicable standards of Fabrication Article.
5. Field corrections of major members will not be permitted without the Architect's prior approval.

L. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
4. For proprietary grout materials, comply with manufacturer's instructions.

M. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

N. Level and plumb individual members of structure within specified AISC tolerances.

O. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which stricture will be when completed and in service.

P. Splice members only where indicated and accepted on shop drawings.

Q. Erection Bolts: On exposed welded construction, remove erection bolts, Fill holes with plug welds, and grind smooth at exposed surfaces.
   1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
   2. Do not enlarge unfair holes in members by bunting or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

R. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

3.3 TOUCH-UP PAINTING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.4 QUALITY CONTROL AND QUALITY ASSURANCE

A. Codes:
   1. Quality Assurance Agency Practices
      a. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminus Materials as used in Construction
      b. ASTM E543 - Standard Practice for Agencies Performing Nondestructive Testing
      c. ASTM E1212 - Standard Practice for Establishment and Maintenance of Quality Control Systems for Nondestructive Testing Agencies
   2. Magnetic Particle Testing (MT)
      a. ASTM E709 - Standard Guide for Magnetic Particle Examination
      b. ASTM E1444 - Standard Practice for Magnetic Particle Examination
   3. Ultrasonic Testing (UT)
      a. ASTM E587 - Standard Practice for Ultrasonic Angle-Beam Examination by the Contact Method
      b. ASTM E114 - Standard Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method
      c. ASTM E164 - Standard Practice for Contact Examination of Weldments
      d. ASTM A898 - Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Structural Shapes
      e. ASTM A435 - Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates

4. Nondestructive Testing Personnel Qualification
    a. ANSI/ASNT CP-189-1995, ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel;

or

    b. ASNT Recommended Practice No. SNT-TC-lA, Personnel Qualification and Certification in Nondestructive Testing, 1995

B. Submittals
1. The Quality Assurance Agency shall submit the following items:
    a. Qualifications of QA Agency's management and QA personnel designated for the project,
    b. QA Agency's Written Practice, as defined in 3.6B2,
    c. Qualification records for Inspector and NDT technicians designated for the project,
    d. QA Agency's NDT procedures, equipment calibration records, and personnel training records, and
    e. QA Agency's Quality Control Plan for the monitoring and control of the Agency's operations.
2. Written Practice for Quality Assurance Agencies
    a. The Quality Assurance Agency shall maintain a Written Practice for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualification and certification of inspection personnel. The Written Practice shall also describe the Agency's procedures for determining the acceptability of the structure in accordance with the applicable codes, standards, and specifications. The Written Practice shall also describe the Agency's inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.
    b. Bolting Inspection Procedures
        i) Bolting inspection procedures shall meet the requirements of the RCSC Specification and the Quality Assurance Plan. Inspection procedures shall be written specifically for the installation and pretensioning methods to be used, i.e. turn-of-nut method, calibrated wrench method, twist-off bolt method, or direct tension indicator method. Written procedures shall also be prepared for the arbitration of disputes, to be used should a dispute arise regarding the pretension of previously installed fasteners.
    c. Welding Inspection Procedures
        i) Welding inspection procedures shall meet the requirements of the AWS D1.1 and the Quality Assurance Plan.
    d. Shear Connector (Stud) Inspection Procedures
        i) Shear connector inspection procedures shall meet the requirements of the AWS D1.1 and the Quality Assurance Plan.

C. Inspector Qualifications
1. Special Inspector Qualifications
    a. Special Inspectors shall be trained and competent, to the satisfaction of the party responsible for the Quality Assurance Plan, to provide the assigned special inspection tasks.
2. Welding Inspector Qualifications

a. All Welding Inspectors shall have adequate visual acuity, documented by vision testing performed within the past three years, in accordance with AWS D1.1, Section 6.1.4.4.
b. All Welding Inspectors shall be trained and thoroughly experienced in inspecting welding operations, and qualified in accordance with AWS D1. 1, Section 6.1.4.
c. For welds in Seismic Weld Demand Categories A and B, welding inspectors shall be AWS Certified Welding Inspectors (CWI), or Senior Certified Welding Inspectors (SCWI), as defined in AWS QC1, Standard and Guide for Qualification and Certification of Welding Inspectors, latest edition.
d. For welds in Seismic Weld Demand Category C, welding inspection personnel shall be AWS Certified Associate Welding Inspectors (CAWI) or higher, or otherwise qualified under the provisions of AWS D1.1-98, Section 6.1.4, to the satisfaction of the party responsible for the Quality Assurance Plan.
e. The use of assistants in inspection operations is permitted, provided the assistants are adequately trained in their responsibilities, and are under the close supervision of the inspector responsible for the joint or connection being inspected.
f. The qualification of an inspector previously certified as a CWI is acceptable, although the certification may have expired, provided the inspector has remained active in the inspection of welded steel fabrication

3. Bolting Inspector Qualifications
   a. Bolting inspectors shall be trained and qualified to inspect bolting operations and highstrength bolted connections for compliance with the RCSC *Specification* and the Quality Assurance Plan. Competency shall be demonstrated through the administration of a written examination and through the hands-on demonstration by the Inspector of the methods to be used for bolt installation and inspection.

D. Contractor Tasks
   1. The Contractor shall provide the management, personnel, equipment and services necessary to perform the Quality Control functions required in Sections 3.6F, 3.6G, 3.6H and 3.6I.

E. Quality Assurance Agency Tasks
   1. The Quality Assurance Agency shall provide the management, personnel, equipment and services necessary to perform the Quality Assurance functions required in Sections 3.6F, 3.6G, 3.6H and 3.6I.

F. Special Inspection
   1. The Special Inspector shall perform the following inspection tasks, if so designated in the Quality Assurance Plan.
      a. Ascertain that all material complies with the Contract Documents, either by material and product certifications and/or by testing.
      b. Evaluate the Contractor's QC program and its effectiveness.
      c. Verify that the fabricator is properly implementing the fabrication procedures and quality control procedures.
      d. Verify the qualifications of the QC and QA Inspectors and the NDT technicians.
      a. Inspect the steel frame to verify compliance with the details shown on the approved construction documents, such as bracing, stiffening, member locations and proper application of joint details at each connection.

b. Verify that all fabrication and erection, including welding and bolting, is performed in accordance with the Contract Documents.
c. Keep written records of the inspections performed.
d. Distribute copies of written records to the Owner, Engineer, Contractor and/or Building Official, as specified in the Quality Assurance Plan. Records documenting correction of nonconformance shall be distributed to the same organizations as those receiving reports of nonconformance.
e. Upon completion of the Inspector's tasks, issue a written report stating that all work inspected under the Inspector's charge meets the applicable codes and specifications, and that nonconformances have been corrected or resolved to the satisfaction of the Engineer or other persons in responsible charge.

G. Tests and inspections shall be performed by qualified individuals, engineering companies or testing laboratories who shall perform those special inspections required by Chapter 17 of the California Building Code, those tests and inspections specified below and such other tests and inspections as the Architect, Structural Engineer or Owner may require to establish the acceptability of the work. Testing and inspection services shall be retained by the Owner at his expense except as follows:
1. When tests or inspections reveal failure of materials to meet contract requirements, costs for subsequent tests and inspections will be deducted from the Contract Price.
2. Costs made necessary by excessive inspection time shall be deducted from the Contract Price.

H. Where certified analysis and/or test reports required under "Submittals" are not furnished, or where inspecting agency cannot identify the material or where the source is questionable, material will be tested to determine compliance with Specifications. Costs of tests therefore shall be paid by the Owner but deducted from the moneys due the Contractor.

I. Inspection of shop and field welding shall be in accord with Section 6 of AWS Code and Chapter 17A of California Building Code. The use of liquid penetrant, magnetic particle, radiographic or ultrasonic testing or any other aid to visual inspection will be made by the inspecting agency when such use is considered advisable to assure adequacy of welds. Contractor shall be responsible for cleaning of weld splatter ("dingleberries") where such may interfere with non-destructive testing procedures.

J. Material required for laboratory tests shall be furnished by Contractor, free of additional charges, FOB the testing laboratory. Full cooperation and access shall be offered to the inspection agency for required inspections and tests in shop and field including special access required for non-destructive testing procedures. Samples to be cut from otherwise satisfactorily completed work shall be provided to the testing agency when requested. Costs of removing and replacing such samples shall be paid by the Owner.

K. Owner will engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform test reports. Selected agency will follow requirements of ASTM E329, "Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in construction."
1. Testing agency shall conduct and interpret test, state in each report whether test specimens comply with requirements, and specifically state any deviations thereof.

2. Materials and work shall be subject to inspection at fabricating plant, and building site. Material or workmanship not complying fully with drawings and specifications will not be accepted. Give Architect reasonable notice when ready for inspection. No additional compensation will be paid for any work required to prepare for testing and inspection.
3. Testing Agency shall inspect all shop and field welding. Welding and high strength bolting shall be performed under full-time inspection. Agency will furnish inspectors, and comply with regulations of the local Building Code and certify in writing, upon completion of the work, that welding and high strength bolting has been performed in accordance with drawings and specifications.
4. Testing Agency shall check high strength bolt tightness on not less than 10 percent of bolts selected at random in each high strength shop and field bolt connection. Inspection procedure shall be as described in " Specifications for High-Strength Bolts for Structural Joints" by the Research Council on Riveted and Bolted Structural Joints.
5. Testing Agency shall check welder qualifications prior to the start of work and shall verify that all approved welding procedures are being strictly adhered to.
6. Multi-pass shop and field welds shall be continuously inspected.

L. Materials Testing:
1. Steel shall be identified by heat or melt numbers and accompanied by mill analysis test reports.
2. Steel ordered from the mill shall be used without further local tests, provided an affidavit is given that materials conform to specifications requirements. In case of controversy, tensions and bend tests will be required, performed either locally or at the mill and accordance with requirements for testing local stock.
3. Local stock structural steel may be used, provided one tension and one bend test is made for each 50 tons, or fractional part thereof, of such stock used in the work. Complete 4-sided surface inspection may be required. Each piece of high-strength local stock steel shall be tested and stamped.
4. Make arrangements to machine test required specimens under direction of Testing Agency; provide specimens of dimensions required by applicable ASTM Standard Specifications.

M. Test and Inspection Costs:
1. Cost of testing identified structural steel, except hereunder, shall be paid by Owner.
   a. In the event that steel will be fabricated outside the State in which the project is being constructed, pay all transportation costs and per diem living costs for inspection at fabricators' plants outside of the State.
   b. In the event that fabrication will take place in more than one shop location, pay all additional inspection costs resulting from fabrication.
2. Contractor shall pay cost of testing and inspection of unidentified steel; costs of tests and inspections for all work and materials proved faulty; and all required retesting and inspection, and repairs.

N. Inspector Requirements and Procedures:
1. The lead welding inspector shall be a Certified Welding Inspector (CWI) per AWS-QC-1 Standards. Other welding inspectors performing visual inspection under the supervision of the lead welding inspector shall hold an active and appropriate

certification. Not more than four non-CWI's shall be under the supervision of a CWI.

2. All welding shall be inspected visually as required by AWS D1.1.

END OF SECTION 051200

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   2. Miscellaneous framing supports.
   3. Miscellaneous steel trim.

B. Related Sections include the following:
   1. Division 9 Section “Painting” for field painting.

1.2 DEFINITIONS

A. Exterior: Defined as the following:
   1. Areas, locations, and surfaces that are unprotected, or exposed to environmental elements.
   2. Areas, locations and surfaces within uncontrolled environments.
   3. Areas, locations and surfaces of unconditioned spaces, including belowgrade/underground, partially-exposed, or “covered” parking areas.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: 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.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For items specified.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal fabrications that fails in materials or workmanship within specified warranty period.
1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: 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. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

F. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
   1. Size of Channels: 1-5/8 by 1-5/8 inches or as indicated.
   2. Material: Galvanized steel complying with ASTM A 653, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Anchor Bolts: ASTM F 1554, Grade 36.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
   1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Surface Preparation: SSPC-SP2 Hand Tool Clean and /or SSPC-SP3 Power Tool Clean.

D. Organic Zinc-Rich Primer: Complying with SSPC-Paint 20 and compatible with topcoat, and meets AISC slip coefficient as a Class B Coating.
   1. Surface Preparation: SSPC-SP6 Commercial Blast Clean.
   2. Products:
      a. Tnemec Company, Inc.; Tneme-Zinc 90-97, 2.5 to 3.5 mils DFT (Basis of Design)
      b. Other manufacturers listed in Division 9 Section “High Performance Coatings”.
      c. Or equal.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: 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.

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. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. 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.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. 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.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent

construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Field painted exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.10 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   1. ASTM A 123, for galvanizing steel and iron products.
   2. ASTM A 153, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

D. Field Finish: Comply with Division 9 Section “Painting” for field painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended 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 bolts, 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.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: 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 sectional doors securely to and rigidly brace from building structure.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055134 - ALUMINUM LADDERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Vertical ladders.

B. Related Sections include the following:
   1. Division 7 Section “Roof Accessories” for roof hatch and ladder safety post.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product.

B. Qualification Data: Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

B. Record of successful in-service performance.

C. Sufficient production capacity to produce required units.

D. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum ladders that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Aluminum Ladders: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. O'Keeffe's Inc. (Basis of Design)
   2. Royalite.
   3. Alaco.
   4. Cotterman.
   5. ACL.
   6. Or equal.

2.2 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

C. Fasteners: As recommended by ladder manufacturer.

2.3 VERTICAL LADDERS

A. Product: Model 501 Heavy Duty Tubular Rails Fixed Access Aluminum Ladder by O'Keeffe's Inc. or equal.
   1. Rungs: Not less than 1-1/4 inches in section and 18-3/8 inches long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
   2. Rungs shall withstand a 1,500 pound load without deformation or failure.
   3. Side Rails: Custom extruded rails as indicated on Drawings.

2.4 ALUMINUM FINISHES

A. Mill finish. As extruded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor securely using fasteners specified by manufacturer or others of equivalent or greater strength and corrosion resistance.

END OF SECTION 055134

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included

1. All joists, purlins, ledgers and beams and all rough sheathing except as specifically excluded below.

2. Roof ledgers.

3. Studs, sills, plates, headers, blocking and wood or plywood sheathing at all stud walls and partitions.

4. Furring for finished surfaces, including ceiling framing and wall furring where shown on the drawings, except as excluded below.

5. All rough hardware except that fabricated steel connections, with bolts, shall be furnished under another section and installed under this section and except as excluded below.

6. Rough hardware except as excluded below.

7. Installation, only, of fabricated steel connections with bolts.

8. Roof sheathing.

9. All required rough framing at floor openings.

10. All required rough framing at roof openings.

11. Sleepers for roof-mounted mechanical equipment.

12. Soffit framing and sheathing at entrances.

13. Soffit Framing at entrances.

14. Exterior gypsum board soffit sheathing.

15. Exterior wood trim.

16. Sheathing paper at exterior siding.

17. Wood doors, frames, casings and trim.

18. Cant strips at roofing.

19. Fire retardant treatment where called for on drawings.

20. Installation only of finish hardware.

B. Related Work Specified Elsewhere

1. Millwork and finish carpentry.

2. Soffit sheathing at entrances.

3. Gypsum board.

4. Concrete formwork.

5. Furnishing only of:

a. Fabricated steel connections, with bolts.

b. Finish hardware.

11. Stripping for acoustical tile.

12. Paving and landscaping header boards.

1.2 REFERENCES, CODES AND STANDARDS

A. The following references, codes and standards are hereby made a part of this Section and carpentry work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained in the Drawings or these Specifications shall be construed as permitting work that is contrary to code requirements.

1. "Product Guide to Grades and Specifications", American Plywood Association (APA).

2. "Standard Specifications", American Society for Testing and Materials (ASTM).

3. "Califorina Building Code", (CBC), 2022 Edition..

4. "Standard Specifications for Grades of California Lumber", Redwood Inspection Service (RIS).

5. "Standard Grading and Dressing Rule # 17, of the West Coast Lumber Inspection Bureau", (WCLIB) latest edition.

1.3 QUALITY ASSURANCE

A. Plywood sheathing shall be in good condition when installed, free of delaminations, splitting or excessive warping. It shall be this contractor's responsibility to protect the deck from weather until

the roofing contractor begins work. Defective plywood sheets and sheets damaged by weather within this period, shall be replaced upon notification from the Engineer.

1.4 PRODUCT STORAGE

A. Storage of Materials: Lumber shall be piled off the ground in a manner which allows ventilation and drainage and prevents twisting, and affords protection from termites and decay, and shall be adequately protected from the weather.

PART 2 - PRODUCTS

2.1 MATERIALS

1. All lumber shall be new, uniformly sized and S4S unless otherwise noted. Lumber shall be of a moisture content low enough to preclude excessive shrinkage after installation. All lumber shall be graded in accordance with the National Design Specification for Stress Grade Lumber and Its Fastenings, latest edition, by the National Forest Products Association, except that plywood shall be graded in accordance with the rules of the American Plywood Association.

2. All lumber shall meet or exceed the following minimum grades, unless specifically noted otherwise on the drawings.

3. Sills and members contacting concrete on grade: Douglas Fir-Larch, No. 2, pressure treated with an approved preservative.

4. Sleepers for roof mounted equipment or structures: Douglas Fir-Larch, No. 1, pressure treated with an approved preservative.

5. Beams, joists, posts, ledgers, nailers: Douglas Fir-Larch, No. 1.

6. Studs, blocking, plates: Douglas Fir-Larch, No. 1.

7. Roof sheathing shall be plywood panels per U.S. Product Standard PS-1, 2019 edition, and shall meet the requirements for APA Rated Sheathing, Exposure 1 or Exterior. Minimum APA Span rating 32/16. Minimum of 5 plies, regardless of thickness. No Group 5 Species, no composite panels. Thickness as shown on the drawings except that 15/32 inch, 19/32 inch and 23/32 inch may be used where 1/2 inch, 5/8 inch and 3/4 inch, respectively, are shown on drawings. Where so indicated on drawings, panels shall, in addition to the above, be APA Structural 1 panels. All panels shall bear the APA trademark, showing grade, span rating, thickness, exposure, and mill number. Where panels must be cut at walls and openings, minimum dimension of any sheet shall be 2 feet - 0 inches.

8. Plywood wall sheathing: DFPA standard sheathing, CD where covered, AD where exposed.

9. Oriented strand board sheathing may be used in lieu of plywood sheathing at walls and roofs installed under this section, at the contractor’s option. Oriented strand board sheathing shall be APA Rated Sheathing. OSB panels shall be manufactured to meet U. S. Department of

Commerce Voluntary Performance Standard PS 2-18 "Performance Standard for Wood Based Structural Panels". Material shall be such that vertical load capacity, span rating, and allowable wind or seismic shear values, are all equal to or higher than those of the plywood sheathing shown on the drawings.

10. Soffit sheathing: 1/2 inch Rough sawn, Douglas Fir-Larch Plywood, EXT (APA).

11. Soffit sheathing: 1/2 inch resawn, Douglas Fir-Larch Plywood, EXT (APA).

12. Exterior gypsum board sheathing - USG exterior gypsum sheathing, or equal.

13. Nails: All nails at framing connections shall be common wire nails, except that plywood roof and wall sheathing, if included in this section, shall be nailed with reduced length approved plywood nails.

14. Bolts, nuts, washers - ASTM A307. Provide malleable iron or steel plate washers at all nuts and heads bearing on wood.

15. Joist hangers shall be Simpson Strongtie or equal unless otherwise noted on the drawings. Framing anchors shall be Simpson Strongtie, A34N at 2x4 framing and A35N at all other framing. Metal straps shall be galvanized steel.

16. Fire Blocking: Conform to California Building Code, 2022 edition.

2.2 MOISTURE CONTENT

A. Structural lumber shall not exceed 19% at the time of fabrication or construction.

2.3 SIZES

A. Surfaced to "DRY" sizes. Sizes noted are nominal unless shown as net.

2.4 SURFACING

A. S4S unless noted or specified otherwise.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

A. Code references refer to California Building Code.

1. Rough framing shall be properly laid out, closely fitted, accurately plumbed, leveled and aligned and rigidly secured in place. Set joists with crown up and bottom edges free from pronounced defects. Studs and joists shall be sized to give true finished surfaces. Sill plates shall be 2 inch minimum thickness.

2. General: Install all wood framing making proper provisions for work of other trades. Do all cutting of wood required to accommodate plumbing, heating and ventilating, electrical and other trades. Fit neatly around all exposed items, such as outlet boxes, conduit, pipes and ducts.

3. Exterior Base Plates or Sills Resting on Concrete: Bed in cement mortar to obtain a continuous bearing. Mortar shall consist of one part cement to three pasts sand. Mix mortar in small quantities so that it can be used promptly. Size all plates or sills and set level and true to line. Bolt down with bolts of size, length and spacing indicated with a bolt not more than 9 inches from the end of any plate.

4. Plywood Sheathing: Install plywood roof sheathing and subflooring with long dimension perpendicular to joists. Install wall sheathing with long dimension vertical. All plywood sheathing and subflooring shall have all edges blocked and nailed for diaphragm or shear wall stresses as shown on the Structural Drawings. All plywood shall be laid with the "C" or best face on exposed side. Sheets shall be laid up with tight joints.

5. Install plywood soffit sheathing with long dimension perpendicular to joists. Lay plywood with best face on exposed side and with tight joints. Have edges blocked and nailed as shown on the drawings.

6. Rough Framing: Fit closely, set accurately to required lines and levels, and secure rigidly in place. Set horizontal and inclined members with crown edge up. Do not cut, notch or bore structural members without specific approval. Bolt, nail and spike in a thorough manner with not less than the sizes and quantities indicated or specified. Structural members shall provide full contact at all bearing surfaces.

7. Studs: Wall and partitions shall be nominal 2 x 4 and 2 x 6 studs 16 inches on center unless otherwise noted or unless they are required to be larger to accommodate mechanical or electrical equipment, piping and fixtures, or the fixtures or equipment of any other trade. Unless otherwise detailed, all panels, valve covers, cleanouts, devices, access doors, recessed cabinet boxes, etc., shall be mounted flush with the adjacent wall surface. When any such item is of a depth where it is not practical to use solid studding to the full thickness of the wall, then the wall shall be furred. When furring is required, it shall extend the full width of the room on the wall in which it occurs and from floor to roof or ceiling joists. The studs comprising all interior partitions and the wall material affixed thereto shall extend from floor to roof or ceiling joist framing except as shown. Staggered stud walls shall be constructed where shown on the plans and as detailed. It shall be the responsibility of the Contractor to meet these requirements at no additional cost to the Owner.

8. Top plates in bearing partitions shall be doubled and lapped at each intersection with walls or partitions. Stagger joints in upper and lower members of top plate not less than four feet.

9. Bridging and blocking: Cut bridging and blocking neatly, fit tightly and nail securely. Install blocking at intersections of finished surfaces to provide adequate bearing for materials. Provide blocking as indicated and as required to support ladders, fixtures, hardware, and other suspended or wall mounted fixtures. Conform to CBC requirements for fire blocking.

10. Provide blocking not less than 2 inch in thickness of same width as stud as follows: Stud partitions or walls more than 8 feet, but not more than 14 feet in height: One row of blocking fitted snugly and nailed into mid-height of stud. Walls or partitions over 14 feet in height: 2

or more rows of blocking. Locate rows of blocking so that in no case will the distance between sole or top plates and blocking or between lines of blocking exceed 8 feet. Provide blocking behind joints of gypsum board and joints of plywood and in all other locations affording a passage for flames.

11. Frame corners solid where stud walls or partitions meet or as shown on the structural drawings.

12. Provide framing for pipes in stud partitions to give proper clearance to piping. Place pipes in center of plates, using a neat hole. Do not notch structural studs or plates unless detailed on the structural drawings. Do not place pipes exceeding 1/3 of plate width in partitions used as bearing or shear walls. Where sills are bored or notched exceeding 1/3 the sill width, provide extra bolts as required for ends of sill pieces. Furr out walls behind water closets, or elsewhere as indicated to receive pipes.

13. Provide double joists headers and side members at all openings larger than 4 feet in dimension.

14. All joist framing into headers and header joists shall be supported on joist hangers.

15. Provide cant strips for roofing as shown on the drawings.

16. Wood Backing and Nailing Strips: Provide all wood backing, furring or blocking indicated or required for proper installation and attachment of work of all other trades. Form lumber which has been cleaned and is in sound condition may be used, unless other material is indicated or specified.

17. Provide wood stripping where indicated for the attachment of finish materials to wood surfaces.

18. Wood Preservative Treatment: (Except for wood treated with fire retardant chemicals.)

    a. All wood sill plates, ledgers bolted in direct contact with concrete, and any wood elements in direct contact with concrete shall be pressure treated in compliance with APA Standard U-1, use Category 2.

19. Sheathing Paper: Shall be 15 # asphalt impregnated Building Paper.

20. Install two (2) layers of Sheathing Paper on exterior wall sheathing, under all cement plaster, lay horizontally starting at bottom, lap edges and ends 6 inches and extend back of window casings and other finish work.

21. All bolts and lag screws must be retightened after installation just before closing in.

B. Building Paper:

1. Furnish and install 15 pound asphalt-saturated rag felt paper, perforated, behind all exterior finish siding.

2. Lap felt paper 2 inches to weather and with 4 inch side laps. Secure with galvanized nails sufficiently to hold in place without sagging until finish is applied.

C. Cutting, Notching and Boring:

1. Minor cutting and boring of the carpentry for the installation of pipes, conduits and ducts may be done by the subcontractor for the applicable trade, but all major cutting, boring and modification shall be done by the contractor under this section.

2. Approval shall be obtained from the Engineer before cutting or notching any framing member.

D. At roof and floor sheathing, all sheet edges not falling over joists or other supports shall be solid blocked with 2 x 4 flat edge blocking, unless otherwise noted. Nailed as indicated on the drawings.

E. Metal cross bridging is unacceptable in lieu of solid blocking.

F. The use of power operated nailing machines, air driven or electric, is subject to a satisfactory jobsite demonstration and the approval of the Structural Engineer and DSA. This approval is subject to continued satisfactory performance. If the nailheads penetrate the outer plys or if the minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory.

G. No portion of the roof deck shall be covered with roofing until inspected by the Engineer or his representative.

H. All trim and casing shall be installed in full lengths, without piecing except where this is impractical, and then shall be jointed with beveled butt joints. Miter all angles. Set all nails and fill holes with putty. All members scribed in place, properly installed, level, plumb and true.

I. Properly install all finish hardware in accordance with the manufacturer's instructions after painting is complete. Clean and polish and leave in good working order.

J. Door frames and trim shall be plumb and square with all joints tightly and accurately fitted together. Set all nails and fill holes with putty. Sand all members and joints smooth.

END OF SECTION 061000

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Plastic-laminate cabinets.
   2. Plastic-laminate countertops.
   3. Solid-surfacing-material countertops.

1.2 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.3 SUBMITTALS

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

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.
   3. Apply WI-certified compliance label to first page of Shop Drawings and follow Section 1, “Guidelines for Architectural Millwork Shop Drawing”.

C. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
   2. Solid-surfacing materials, 6 inches square.
   3. Corner pieces as follows:
      a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
      b. Miter joints for standing trim.
   4. Exposed cabinet hardware and accessories, one unit for each type and finish.
      a. Hardware samples will be returned up on approval.
   5. Resin materials, 6 inches square.
   6. Fabric materials, 6 inches square.

D. Product Certificates: For each type of product, signed by product manufacturer.

E. Woodwork Quality Standard Compliance Certificates for Product and Installation: WI-certified compliance certificates confirming conformance with Certified Compliance Program (CCP).

F. Qualification Data: For Installer and fabricator.

1.4 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: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
   1. Before delivery to job-site, Millwork supplier:
      a. 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.
      b. 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.
   2. Each elevation of casework and each countertop shall bear certified compliance label.
   3. Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of interior architectural woodwork that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. High-Pressure Decorative Laminate:
   1. Wilsonart International; Div. of Premark International, Inc. (Basis of Design)
   2. Formica Corporation.
   3. Pionite.
   4. Nevamar Company, LLC; Decorative Products Div.

5. Arpa.
6. Abet Laminati.
7. Or equal.

B. Solid Surfacing Materials:
1. Wilsonart International; Div. of Premark International, Inc. (Basis of Design)
2. Corian by E. I. du Pont de Nemours and Company.
3. Formica Corporation.
4. Nevamar Company, LLC; Decorative Products Div.
5. LG Hausys.
6. Or equal.

C. Medium-Density Fiberboard:
1. Medex, Medex NC, Medite II, or Arreis SDF by SierraPine Ltd.
2. Weyerhaeuser Company; Premier Plus by Weyerhaeuser.
3. Or equal.

D. Particleboard:
1. Rodman Industries, Inc.
2. Acadia Board Company.
3. PrimeBoard, Inc.
4. Or equal.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Core and Substrates: Comply with the following:
1. Backs of cabinets, book cases, etc.
a. Hardboard: AHA A135.4.
2. Plastic-laminates:
a. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
3. Wood Veneer-Faced Panel Products, melamine, and shelving:
a. Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

D. High-Pressure Decorative Laminate (HPDL): NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
1. Colors: As indicated on Drawings.

E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Type: Standard type, unless Special Purpose type is indicated.
2. Colors: As indicated on Drawings.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Adjustable Shelf Pilaster Standards: Side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
1. 23 gauge high strength steel.
2. 39/64" wide x 11/64" deep.
3. BHMA Grade 1 approved.

B. Shelf Support Pins:
1. Stainless steel.
2. Pin diameter for 5 mm hole (approx 13/64 inch).

C. Grommets: Plastic, 2 inch diameter, locations as indicated. If locations are not indicated, as selected by Architect during shop drawing review or a minimum of 1 Grommet per 3 linear feet of countertop.
1. Doug Mockett or equal.

D. Drawer and Door Pulls: For all, including accessible casework.
1. "U" shaped wire pull, aluminum with satin finish, 4 inch centers.

E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish to key with door hardware. All doors and drawers to be lockable.

F. Hinges: Concealed (fully mortised) self-closing type, BHMA No. 652, steel with polished finish.

G. Drawer Slides: BHMA A156.9, B05091.
1. Heavy Duty (Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Wood Glues: 30 g/L.

2. Contact Adhesive: 250 g/L.

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect 7 days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
1. Seal edges of openings in countertops with a coat of varnish.

E. Drawer bottoms to be fully let-in, glued and blocked. Joinery must be lapped and mitered, no butt joints.

2.6 PLASTIC-LAMINATE CABINETS

A. WI Construction Style: Style A, Frameless.

B. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

C. WI Door and Drawer Front Style: Flush overlay.

D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces Other Than Tops: Grade HGS, 0.048 inches (1.2 mm) thick.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS, 0.048 inches (1.2 mm) thick.

4. Edges: Self-edge banded.

E. Semi-Exposed Surfaces: Any of one of following.
1. Low pressure decorative polyester overlay.
2. Low pressure decorative melamine overlay.
3. HPL cabinet liner.
4. Solid Phenolic core (SPC).
5. Vinyl at cabinet backs and drawer bottoms only.

F. Concealed Surfaces: Any of one of following.
1. Solid Wood or Plywood: Any hardwood or softwood species, with no defects affecting strength or utility. Hardwood and softwood lumber kiln dried to 7 and 10 percent moisture content, respectively.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Medium-Density Fiberboard: ANSI A208.2.
4. Solid Phenolic core (SPC).

2.7 PLASTIC-LAMINATE COUNTERTOPS

A. High-Pressure Decorative Laminate Grade: HGS, 0.048 inches (1.2 mm) thick.

B. Provide Exterior grade plywood at wet locations and comply with following:
1. No seams shall occur within 18 inches of sink cut-outs.
2. Sink cut-outs shall be coated with opaque sealer.
3. Back splash shall coordinate with size of soap and paper tower dispensers for solid attachment.
4. Corners of tops shall be cut at 45 degrees if projecting or in pathway.

C. Edge Banding: Colored PVC tape, to match plastic laminate surface.

D. Laminate Substrates: Medium-density fiber board (MDF). Do not use plywood.

E. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

F. Waterfall edge with backsplash.

G. Marine grade plywood within 4 foot of sinks and at wet areas.

2.8 SOLID- SURFACING MATERIAL COUNTERTOPS

A. Solid-Surfacing-Material Thickness: 3/4 inch.

B. Edge: 1-1/2 inch thick eased edge.

C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

D. Integral Cove: Provide shop fabricated integrally molded coves at back and ends where against walls or other vertical surfaces, with 3/8” radius between top and splash.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 FIELD QUALITY CONTROL

A. Provide Woodwork Institute Certified Seismic Installation Program (CSIP) inspection reports and certification as required in Part 1 of this Section.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 068200 - FIBER REINFORCED PLASTIC PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiber reinforced plastic panel system for adhesive mounting.
   2. Moldings, adhesive, and joint sealants.

1.2 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. Installation methods.

B. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

C. Maintenance Instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.4 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.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fiber reinforce plastic panels that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fiber Reinforced Plastic Panels: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Altro. (Basis of Design)
   2. Marlite.
   3. Formica.
   4. Nudo.
   5. Crane Composites (formerly Kemlite).
   6. Glasteel.
   7. Or equal.

2.2 PANEL SYSTEM

A. Plastic Panel System: Factory finished panels, trim, sealant, and accessories.

B. Product: As indicated on Drawings.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

A. Take panels out of cartons and allow to acclimatize to room conditions for at least 48 hours 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. Clean surfaces thoroughly prior to installation.

D. Protect existing surfaces from damage due to installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use the adhesives recommended by the panel manufacturer unless prohibited by local regulations; obtain manufacturer's approval of alternative adhesives.

C. Install continuous bead of silicone sealant in each joint and trim groove and between trim and adjacent construction, maintaining 1/8 inch expansion space.

D. Avoid contamination of panel faces with adhesives, solvents, or cleaners; clean as necessary and replace if not possible to repair to original condition.

E. Protect installed products until completion of project.

F. Touch-up, repair or replace damaged products after Substantial Completion.

END OF SECTION 068200

SECTION 071909 - CONCRETE MOISTURE AND ALKALINITY TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for independent testing and inspection requirements for concrete moisture and alkalinity.

B. Related Sections include the following:
   1. Division 7 Section “Concrete Moisture and Alkalinity Barrier” for concrete sealers to reduce moisture and alkalinity level when testing fails.

1.2 SUBMITTALS

A. Independent testing agency qualifications: Past 4 year history of testing of comparable project size and scope.

B. Product data: Moisture test kit.

C. Testing Results: Provide interior temperature, humidity, moisture vapor and alkalinity results for testing period.
   1. Alkalinity and Adhesion Test Report.
   2. Moisture Test Report.

D. Locations Map: Provide each testing result documented on a locations map. Map may be finish floor plan by Architect or similar representation.

E. Record Submittals: Testing reports and locations map.

1.3 SCHEDULING

A. Site Meeting: Testing Agency, Owner, Architect and Contractor shall meet 30 days prior to flooring installation to discuss testing requirements, specifications and locations prior to testing.

PART 2 - PRODUCTS

2.1 MOISTURE TESTING

A. Test Method: ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
   1. ASTM F 1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride is NOT acceptable method.

B. The In-Situ Method:
   1. In-situ probes deepen concrete moisture measurement. For decades, builders used (and some still do) the anhydrous calcium chloride test for concrete moisture vapor emissions rate (MVER). The MVER is defined as the rate of water vapor emissions from the surface of concrete and is determined with the use of a desiccant material sealed to the slab surface for a specified time period, then measured. It has been believed that the change in the desiccant weight could be translated into a moisture ratio for the concrete beneath.
   2. In-situ concrete moisture testing places sensors, or probes, inside the slab itself. As concrete dries, moisture migrates from the bottom of the slab to the surface where it can evaporate away. Logically then, moisture levels at the bottom of a slab will read higher from those at the surface. In-situ probes provide relative humidity (RH) measurements at 40% of the slab's depth*, a position proven to more accurately portray the final RH levels of the slab if it were to be sealed at that point in time and the slab moisture allowed to fully equilibrate.

C. Acceptable Testing Devices for ASTM F2170 Test:
   1. Wagner Meters Rapid RH® system by Wagner.
   2. Protimeter by T Equipment.
   3. Relative Humidity Meter system by American Moisture Test.
   4. Or equal.

2.2 ALKALINITY TESTING

A. Alkalinity Test, ASTM F 710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
   1. Digital wide range 1–14 pH meter.
   2. Waterproof flat tip.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site: Weatherproofed, doors installed and windows secured. Do not start testing process when site has standing water, surface contaminates, exposed to exterior conditions or concrete installation is less than 90 days of age.

3.2 PREPARATION

A. Clean concrete substrates of adhesives residue, paint, curing, sealing, floor coverings a minimum of 24 hours prior to installation of testing equipment.

B. Temperature & Humidity: Maintain site at the temperature and humidity conditions to those anticipated during normal occupancy and maintain these conditions minimum of 7 days (exceed ASTM F1869 requirements) prior and during testing period.

C. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with testing results.

3.3 MOISTURE TESTING

A. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F2170.

B. Floor shall have reading of 95% or less per ASTM F2170; unless finish flooring product require better value.

3.4 ALKALINITY TESTING

A. Test: Perform pH testing per ASTM F710.

B. pH range between 8 and 10; unless finish flooring product require better value.

3.5 FIELD QUALITY CONTROL

A. Testing: Engage and pay for qualified independent testing agency specified to perform the following field tests and inspections and prepare test reports:
   1. Testing agency shall perform tests for characteristics specified, using applicable referenced testing procedures.
   2. Testing agency shall verify thickness of coatings during traffic coating application.
   3. If test results show coating materials do not comply with requirements, remove noncomplying materials, prepare surfaces, and reapply coatings.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 071909

SECTION 071910 - CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes concrete stain and sealer.

1.2 SYSTEM DESCRIPTION

A. Ground and Floor Surfaces: Slip resistant per CBC 11B-302.1.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include manufacturer's printed statement of VOC content.

B. Samples for Initial Selection: For each type of stain finish indicated.

C. Samples for Verification: For each type of stain required, prepared on rigid backing and of same thickness and material indicated for the Work.

D. Samples: For each type of sealer and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

E. Manufacturer Certificates: Signed by manufacturers certifying that water repellents comply with requirements.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
   1. Ambient temperature is above 40 deg F.
   2. Concrete surfaces and mortar have cured for more than 28 days.
   3. Concrete or brick masonry walls are not treated prior to 30 days after building close-in.
   4. Rain or snow is not predicted within 24 hours.
   5. Application proceeds more than 24 hours after surfaces have been wet.
   6. Substrate is not frozen, or surface temperature is above 40 deg F.
   7. Windy conditions do not exist that may cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Patching compound, cementitious, thin patching and skim-coating material, designed for reducing surface defects on interior floors. : Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Degussa.
   2. ChemMasters.
   3. Or equal.

B. Concrete stain chemically combines with cured concrete to produce permanent, variegated or translucent color effects: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Scofield/Sika. (Basis of Design)
   2. Degussa.
   3. ChemMasters.
   4. Or equal.

C. Concrete Clear Sealer for protecting antiqued, imprinted, chemically stained, exposed-aggregate, and colored or uncolored concrete hardscapes and floors: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Scofield/Sika. (Basis of Design)
   2. Consolideck LS by Prosoco.
   3. Degussa.
   4. ChemMasters.

5. Or equal.

2.2 PATCHING COMPOUND

A. Patching compound, cementitious, thin patching and skim-coating material, designed for reducing surface defects on interior floors.
   1. Composition and Materials:
      a. Complex, precisely engineered, polymer-modified, cementitious, thin patching material produced by a proprietary manufacturing and intergrinding process.
      b. Designed for ease of mixing and installation, superior adhesion without priming, and rapid strength gain, it is a single-component, non-gypsum-based, powdered material containing no sand or calcium chloride.

2.3 STAIN

A. Product: Formula One Liquid Dye Concentrate by Scofield or equal.
   1. Acetone soluble dye, formulated to color interior concrete surfaces.
   2. Colors: As indicated on Drawings.

2.4 SEALER

A. Product: Formula One K by Scofield.
   1. Chemically reactive treatment based on potassium silicate.
   2. VOC-compliant, penetrating, colorless, transparent liquid for use on concrete to reduce porosity, protect the surface, reduce dusting, significantly improve abrasion resistance and provide overall long-term durability.
   3. Compatible with colored and uncolored concrete.
   4. Does not contain sodium silicate.
   5. Exceed SCAQMD Rule 1113 for VOC’s.
   6. Test Results:
      a. Taber Abrasion Resistance: 10-40% increase in abrasion resistance per ASTM D4060, H-22, 1000g, 1000 cyc.
      b. Elcometer pull-off adhesion: 25-65% increase in bond strength per ASTM D4541.
      c. Rebound # Compressive: 5-20% increase in compressive strength per ASTM C805.
      d. Water uptake: 10-40% absorption mL/hr per Rilem Tube Method.
      e. Artificial weathering, UV: No change in color or apprearance per ASTM G154, 1000hr, 4/cond, 8/UV.

PART 3 - EXECUTION

3.1 PREPARATION

A. New Concrete:
   1. Newly placed concrete shall be sufficiently cured to allow concrete to become reactive, minimum 28 days.

2. Do not use liquid curing materials. Cure concrete flatwork with new, unwrinkled, non-staining, high quality curing paper. Do not overlap curing paper.
3. Surfaces shall be cured using the same method and different sections (pours) chemically stained when the concrete is the same age.
4. Immediately prior to chemically staining, thoroughly clean the concrete. Sweep surfaces, the pressure wash or scrub using a rotary floor machine. Use suitable, high-quality commercial detergents to facilitate cleaning. Rinse surfaces after cleaning until rinse water is completely clean. Allow floor to dry completely prior to application of floor stain.
5. Concrete surfaces must be uniformly slip-resistant and profiled to meet a Concrete Surface Preparation (CSP) profile of 1-2 per ICRI guidelines.
6. Some concrete may require abrading to open the surface and make it sufficiently penetrable. In these instances the concrete surface must be sanded using an 60-80 mesh-sanding screen or a grit brush. After sanding, all residue must be removed by power vacuuming. The surface should then be pressure washed or scrubbed using a rotary floor machine.
7. For preparation, the sandblaster should be capable of producing a light, uniform sandblast and be equipped with a dust collector.
8. For preparation, the pressure washer should be equipped with a fan tip and have a minimum pressure capability of 4000 psi. Hot water capability may facilitate cleaning of existing concrete.
9. Acid washing may be required when the above surface preparation does not yield adequate penetration or if there are excessive alkali deposits or surface discoloration. The reacted residue must be abraded using a low-speed floor machine equipped with a 60 mesh screen or a grit brush and then thoroughly rinsed until the rinse water is clear and free of solids, a minimum of two times. After rinsing, neutralize any remaining acid residue by washing with a solution of baking soda (sodium bicarbonate) and water. (Test pH of floor should be 7 or higher.)

B. Existing Concrete:
1. Clean concrete surfaces so that surfaces are completely penetrable before receiving the initial application of chemical stain. Test surfaces to receive stain by spotting with water. Water should immediately darken the substrate and be readily absorbed. If water beads and does not penetrate or only penetrates in some areas, additional surface preparation and testing shall be performed.
2. Cleaning method used depends on the condition of the concrete surface. To remove dirt and other contaminates, detergents and other commercial grade cleaners should be considered and tested.
3. Rinse concrete substrates until rinse water is completely clean.
4. For preparation of interior floors, the rotary floor machine should be heavy duty and operate at approximately 175 rpm. With a 60-80 mesh-sanding screen or a grit brush, remove all contaminates and weak cement paste from the surface. This will also open the surface to allow the chemical stain to penetrate.
5. Acid washing may also be required. (Refer to New Concrete Preparation.)

C. Scoring: Score decorative jointing in concrete surfaces 1/8-inch (3.2 mm) deep with diamond blades. Rinse until water is completely clean.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

E. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

F. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.2 APPLICATION OF WATER-BASED REACTIVE STAIN

A. Concrete surfaces shall be dry and properly prepared as described above. Protect surrounding areas from over-spray, run-off and tracking. Divide surfaces into small work sections using wall, joint lines, or other stationary breaks as natural stopping points.

B. Apply water-based reactive stains full strength (undiluted) at the coverage rate recommended by the manufacturer and use application equipment described in the manufacturer’s printed technical literature. The color of the liquid chemical stain has no resemblance to the final color produced on the concrete substrate.

C. Apply water-based reactive stain to the substrate with an airless sprayer or HVLP sprayer.

D. Reaction time depends on wind conditions, temperatures, and humidity levels.

E. The second coat, if required, should be applied after the first coat has dried sufficiently and can be walked on without damage, normally 2-4 hours after application depending on temperature and humidity. A third coat could be applied 2-4 hours after the second coat.

F. On vertical surfaces, spray applications of stain should start at the bottom and proceed upward. The material should be applied in light coats while maintaining a wet edge to ensure penetration into the surface.

3.3 APPLICATION OF SEALER

A. Concrete substrate shall be completely dry.

B. Sealer shall be produced by the water-based reactive stain manufacturer.

C. After the final stain application has dried sufficiently, normally 8-24 hours at 75 F and 50 percent relative humidity, remove all contaminates from the surface by dry mopping if required.

D. Apply sealer according to manufacturer’s written instructions at a rate of 300 to 500 square feet per gallon per coat. Two coats are required.

E. Maintain a wet edge at all times.

F. Allow sealer to completely dry before applying additional coats.

G. Apply second coat of sealer at 90 degrees to the direction of the first coat using the same application method and rates.

H. Seal horizontal joints in areas subject to pedestrian or vehicular traffic.

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071910

SECTION 071920 - CONCRETE MOISTURE AND ALKALINITY BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Concrete moisture and alkalinity barrier when moisture or alkalinity test fails.

B. Related Sections include the following:
   1. Division 7 Section “Concrete Moisture and Alkalinity Testing” for independent moisture and alkalinity testing prior to installation of flooring materials.

1.2 PERFORMANCE REQUIREMENTS

A. Ground and Floor Surfaces: Slip resistant per CBC 11B-302.1.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include manufacturer's printed statement of VOC content.

B. Samples: For each type of barrier and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

C. Manufacturer Certificates: Signed by manufacturers certifying that barrier comply with requirements.

D. Qualification Data: For Installer.

E. Product Test Reports: Independent third party testing results:
   1. ASTM E 96 Water Vapor Transmission: up to 95% Vapor Reduction
   2. ASTM D 4541 Concrete Adhesion: 500psi or concrete cohesive failure
   3. ASTM D 1308 Chemical Resistance: 100% resistant to acid and alkali

F. Field Quality Control Documents: Post installation testing by independent testing agency per ASTM F1869, ASTM D 4541.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Extended Warranty Period: Barrier warranty for 15 years covering performance, concrete adhesion, moisture or alkalinity damage to barrier and installed floor coverings. In the event of barrier failure, manufacturer shall cover labor and material cost to replace moisture or alkalinity

damaged flooring or coatings, reapply barrier, adhesives, patching compounds and installation accessories.

1. Moisture Vapor Reduction: No upper performance limitations.
2. Alkalinity Control: No upper performance limitations.
3. Manufacturing defects warranties are not acceptable.

B. Warranty shall not exclude ACI documents, dew point, concrete salts, admixtures, resin and silicate surfaces treatments. Installations on slab surfaces deems acceptance of on site conditions. Barrier manufacturer is responsible for complete review of concrete mix designs, admixtures, sub slab vapor barrier installed and curing methods for written acceptance prior to installations.

C. Installer: Submit 15 year warranty covering installation defects and improper installations on workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Concrete Moisture and Alkalinity Barrier: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.

1. VAP-1 2000 FS by Koster. (Basis of Design)
2. Vapor-Guard DC by Advance Moisture Control.
3. MES 100 by Floor Seal Technology Inc.
4. Or equal.

2.2 CONCRETE MOISTURE AND ALKALINITY BARRIER

A. Product: VAP I 2000 FS by Koster or equal.

1. Fast-setting, one-coat, membrane-forming, moisture vapor control system consisting of a unique combination of epoxy resins and other compounds formulated to prevent floor covering failures on concrete slabs with elevated levels of moisture.
2. Meets or exceeds the performance requirements in ASTM F3010-13 Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.
3. Has no upper limit for water vapor emission from concrete floor slabs. It can be applied to concrete slabs with relative humidity up to 100% RH and it provides protection from sustained exposure to pH 14.
4. Low permeance of 0.047 perms, moisture blocker for virtually all types of flooring, including low permeance flooring such as sheet goods and rubber tile.
5. Compliant with all state and federal VOC regulations, having VOC content of 0 g/L, which allows installation in sensitive areas such as hospitals, schools, and grocery stores.

B. Concrete Topcoat: Cement based self-leveling underlayment product acceptable to sealant manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to barrier manufacturer's written instructions, to ensure that surface is dry enough.
   1. Shot blast surface to allow maximum penetration and adhesion. Grind near walls and edges.

B. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

C. Coordination with Sealants: Do not apply barrier until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Barrier work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Barrier: Apply by squeegee and roller application methods to saturate entire surface. Spread rates shall produce results of up to 95% moisture reduction per ASTM E 96 and post installation testing rate specified.

B. Roller and squeegee methods to saturate concrete porosity. Final surfaces shall be light reflective white.

C. Joint and Crack Treatment: Apply barrier directly over cracks, holes, and slab imperfections for maximum flexibility, moisture vapor and alkalinity control.

D. Cement Topcoat: As required for applications under resilient flooring for sealants installed after curing of concrete.

3.3 FIELD QUALITY CONTROL

A. Site Tests:
   1. Conduct moisture-alkalinity test by an independent testing company prior to resilient flooring and carpet installation.

3.4 CLEANING

A. Immediately clean barrier from adjoining surfaces and surfaces soiled or damaged by barrier application as work progresses. Repair damage caused by barrier application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071920

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Concealed thermal and sound insulation.

B. Related Sections include the following:
   1. Division 9 Section "Gypsum Board" for installation in metal-framed assemblies of insulation specified by referencing this Section.

1.2 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.3 SUBMITTALS

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

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of building insulation that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass-Fiber Batt/Blanket Thermal and Sound Insulation: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Johns Manville (JM). (Basis of Design)
   2. CertainTeed Corporation.
   3. Guardian Fiberglass, Inc.
   4. Knauf Fiber Glass.
   5. Owens Corning.
   6. Lamtec.
   7. Or equal.

2.2 GLASS-FIBER BATT/BLANKET INSULATION

A. Unfaced, Glass-Fiber Batt/Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. Glass-fiber bonded with acrylic thermosetting binder.
   1. For walls and partitions: Unfaced Batts.
   2. Formaldehyde-free, Unfaced Batts by JM or equal.

B. Faced, Glass-Fiber Batt/Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft vapor-retarder membrane on 1 face.
   1. For ceilings under decks: FSK-25 Faced Batts with 2 inch tabs or Panel Deck FSK-25 Faced Batts with 5 inch tabs.
   2. Formaldehyde-free, FSK-25 Faced Batts by JM or equal.

C. Thermal Rating: R values as indicated on Drawings.
   1. 2x6 walls: R-21.
   2. 2x8 walls: R-25.

2.3 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inches wide.

B. Nails or Staples: Steel wire; electroplated, or galvanized; type and size to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install insulation in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
   4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.
   6. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:

D. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces for sound deadening, sound absorption, thermal protection, or air-infiltration reduction. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

3.5 INSTALLATION OF INSULATION IN CEILINGS

A. Install insulation to achieve thermal indicated attached to roof or floor deck from below.

B. Insulation to roof or floor deck: Install by one of following methods.
   1. Staple insulation to sides of joists or trusses at 4 inches o.c. through bent down flanges of vapor barrier in such manner that air leaks between insulation and joints are minimized.
   2. Fasten insulation anchors to deck substrates with insulation anchor according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072419 - EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide air and water-resistive barrier, and compatible EIFS for vertical above grade exterior walls
2. Transition flashing for EIFS, windows, doors, parapets, and other openings and where indicated on Drawings.

B. Related Sections:

1. Division 7 section “Sheet Metal Flashing and Trim”

1.2 SUBMITTALS

A. Manufacturer's specifications, design guide and details, installation instructions, and product data

B. Manufacturer’s code compliance report and UL Listing for continuous insulation component

C. Manufacturer's standard warranty

D. Applicator's industry training credentials

E. Samples for approval as directed by architect or owner

F. Sealant manufacturer's certificate of compatibility

G. Prepare and submit project-specific details (when required by contract documents)

1.3 PERFORMANCE REQUIREMENTS

A. Air and Water-resistive Barrier

1. Air leakage less than 0.004 cfm/ft^2 at 1.57 psf when measured in accordance with ASTM E2178
2. Assembly air leakage less than 0.04 cfm/ft^2 after conditioning protocol when measured in accordance with ASTM E2357
3. Vapor Permeable Barrier, water vapor permeance greater than 10 perms when measured in accordance with ASTM E96, Method B
4. Vapor Impermeable Barrier, water vapor permeance less than 0.1 perms when measured in accordance with ASTM E96, Method A
5. No water penetration when subjected to a water spray at a minimum 2.86 psf pressure differential for 15 minutes in accordance with ASTM E331

B. EIFS

1. Meets or exceeds durability requirements of ASTM E2568
2. Drainage efficiency greater than 95% when measured in accordance with ASTM E2273
3. Flame spread and smoke development of lamina (base coat, reinforcing mesh, and finish) less than 25 and 450, respectively, when tested in accordance with ASTM E84
4. Meets acceptance criteria of NFPA 285 for use on non-combustible construction
5. No ignition when exposed to radiant heat in accordance with NFPA 268
6. Maintains hourly fire resistance rating of known, rated wall assembly when tested in accordance with ASTM E119
7. Meets standard impact resistance with Sto Mesh, meets Ultra-High impact resistance with Sto Mesh and Sto Armor Mat, when measured in accordance with ASTM E2486

1.4 COMPLIANCE

A. Air and Water-resistive Barrier

1. Meets requirements of ICC AC212 for coatings used as WRBs on sheahting

B. EIFS Cladding with Drainage

1. Meets requirements of ICC AC235 for EIFS clad drainage wall assembly

C. Accessories: Joint Sealant for Use with EIFS

1. Conforms with ASTM C920: Type S, Grade NS, Use NT, A, M, Class 100/50
2. Tested in accordance with ASTM C1382
3. Meets Federal Specification TT-S-00230C Type II
4. Conforms with AAMA 808.3 (Type1) Exterior Perimeter Sealing

1.5 QUALITY ASSURANCE

A. Manufacturer Requirements

1. Member in good standing of the EIFS Industry Members Association (EIMA) for over thirty (30) years
2. Air and water-resistive barrier and EIFS manufacturer for a minimum thirty (30) years
3. Manufacturing facilities in compliance with ISO 9001 Certified Quality System and ISO 14001 Certified Environmental Management System

B. Contractor Requirements

1. Engaged in application of similar systems for a minimum of three (3) years
2. Knowledgeable in the proper use and handling of Sto materials
3. Employ skilled mechanics who are experienced and knowledgeable in air and water-resistive barrier and EIFS application, and familiar with the requirements of the specified work
4. Successful completion of minimum of three (3) projects of similar size and complexity compared to the specified project

5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with Sto's published specifications and details and the project plans and specifications

C. Insulation Board Manufacturer Requirements

1. Graphite Polystyrene (GPS) insulation board listed by an approved agency and in compliance with the applicable building code

D. Substrate Requirements

1. All substrates shall be in compliance with the applicable building code for strength, durability, resistance to weather, and fire resistance, and other safety requirements

2. Exterior or Exposure 1 wood sheathing - plywood or OSB – in conformance with Product Standard 2 (PS 2) and installed in accordance with the applicable building code to resist design wind pressures with appropriate safety factor. Surface shall be clean, dry, and free of frost, damage, dust, dirt, oil or other contaminants that could interfere with adhesion

E. Mock-ups and Testing

1. Construct full-scale mock-up of typical air and water-resistive barrier and EIFS/window wall assembly with specified tools and materials and test air leakage, water infiltration. and structural performance in accordance with ASTM E283, ASTM E331 and ASTM E330, respectively, through independent laboratory. Mock-up shall comply with requirements of project specifications. Where mock-up is tested at job site maintain approved mock-up at site as reference standard. If tested off-site accurately record construction detailing and sequencing of approved mock-up for replication during construction.

2. Conduct AWRB adhesion tests in accordance with ASTM D4541 to foundation waterproofing, roofing material, and any other unknown or untested AWRB substrate connections to verify adequacy of adhesion.

F. Inspections

1. Provide independent third-party inspection where required by code or contract documents

2. Conduct inspections in accordance with code requirements and contract documents

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product

B. Protect coatings and adhesives (pail products) from freezing and temperatures in excess of 90°F. Store away from direct sunlight

C. Protect portland cement-based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location

D. Store foam adhesive in a clean, dry area at room temperatures ranging from 50 to 75ºF. Protect from freezing and direct sunlight. Avoid contact with water. Keep away from sources of heat, sparks, flame, ignition, and physical abuse.

E. Store gun-grade air barrier component and gun-grade sealant at temperatures between 40 and 80°F, and protect from freezing, moisture, direct sunlight, and keep away from sources of ignition

F. Keep products packaged in cartons off the ground in a cool dry environment

G. Insulation material is combustible. Keep away from flame or ignition sources, direct sun exposure, high heat, and temperatures in excess of 165°F

H. Store and handle all products as directed on labeling

1.7 PROJECT/SITE CONDITIONS

A. Maintain ambient and surface temperatures above 40°F during application and drying period, minimum 24 hours after application of air and water-resistive barrier and EIFS products

B. Provide supplementary heat for installation in temperatures less than 40°F

C. Provide protection of surrounding areas and adjacent surfaces from application of products

1.8 COORDINATION/SCHEDULING

A. Provide site grading such that the EIFS terminates above grade a minimum of 6 inches or as required by code

B. Provide roofing and protection at roof and floor levels to prevent excess water entry to the interior or into and behind the exterior wall during construction.

C. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuously connected air and water-resistive barrier

D. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall

E. Install window and door head flashing immediately after windows and doors are installed

F. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior

G. Install splices or tie-ins from air and water-resistive barrier over back leg of flashings, and similar details, to form a shingle lap that directs water to the exterior

H. Install copings and sealant immediately after installation of the EIFS when coatings are dry, and such that, where sealant is applied against the EIFS surface, it is applied against the base coat or primed base coat surface

I. Schedule work such that the air and water-resistive barrier is exposed to weather no longer than the period allowed by the manufacturer

J. Attach penetrations through the EIFS to structural support and provide watertight seal at penetrations

1.9 WARRANTY

A. Manufacturer: 15 years.

B. Installer: 3 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide air and water-resistive barrier and EIFS materials from single source manufacturer or approved supplier

1. ICC ESR-1748.
2. Sto Corp. – Air and water-resistive barrier, EIFS Cladding, EIFS Accessories
3. GPS Insulation Board – Atlas Molded Products, A Division of Atlas Roofing Corporation, as furnished by Sto Corp.
4. Or equal.

2.2 AIR AND WATER-RESISTIVE BARRIER

A. StoGuard Detail Components for sheathing joint treatment, rough opening protection, counterflashing, and static joints and seams:

1. Sto Gold Coat, Sto AirSeal, or StoGuard VaporSeal: brush, spray or roller applied air and water-resistive barrier coating used with StoGuard Fabric reinforcement
2. Sto RapidGuard: single component rapid drying gun-applied STPE detail component
3. Sto Gold Fill: trowel applied detail component used with StoGuard Mesh, glass fiber self-stick reinforcing mesh
4. StoGuard Conformable Membrane: self-adhered membrane flashing

B. Static and Dynamic Joints

1. StoGuard Conformable Membrane: self-adhered membrane

C. Air and Water-resistive Barrier Coating

1. Sto Gold Coat: ready mixed vapor permeable air and water-resistive barrier coating applied
   a. By substrate as follows:
      - Plywood: apply one coat at minimum 10 mils WFT
   b. To achieve Medium-Build apply in one or two coats to achieve minimum 20 mils WFT. If applied by roller apply two coats to achieve minimum 20 mils WFT. For CMU substrates apply two or three coats to achieve 20-60 mils WFT.

2.3 INSULATION ADHESIVE

A. One component polyurethane foam adhesive

1. Sto TurboStick®

2.4 INSULATION BOARD

A. Graphite Polystyrene Insulation Board

1. Sto GPS Board: nominal 1.0 lb/ft^3 graphite enhanced polystyrene rigid foam plastic insulation board in compliance with ASTM E2430 and ASTM C578 Type I requirements, R-4.7 per inch, listed, labelled, and furnished.

2.5 FIREBLOCKING

A. Sto Lamella

1. Nominal 8.5 lb/ft^3 noncombustible, semi-rigid mineral wool insulation board in compliance with ASTM C612

2.6 BASE COAT

C. Waterproof Base Coat

1. Sto Watertight Coat: two component kit consisting of factory blended latex additive and dry component that forms a waterproof base coat material (equivalent to Sto Flexyl)

2.7 REINFORCING MESHES

A. Open weave glass fiber reinforcing meshes treated for compatibility with Sto materials

1. Sto Mesh 6oz – nominal 6 oz/yd^2 (203 g/m^2) for areas requiring standard impact resistance and high build base coat
2. Sto Intermediate Mesh – nominal 11.2 oz/yd^2 (380 g/m^2) for areas requiring high impact resistance – up to 8 feet above finished grade and where accessible to pedestrian traffic and other areas exposed to abnormal stress or imact.
3. Sto Detail Mesh – nominal 4.2 oz/yd^2 (143 g/m^2) for back wrapping, diagonal reinforcement at corners of openings, reveals, complex architectural features, and other areas of detail work

2.8 STRIKE DEFENSE

A. StoArmat Classic Plus - cement-free high build acrylic-based plaster material used with Sto Mesh to form Sto Strike Defense

2.9 PRIMER

A. Sto brush, roller, or spray-applied primer as dictated by substrate condition or finish selection

2.10 FINISH

A. Lotusan Exterior Insulation Finishing System with graded marble aggregate, self-cleaning properties.

2.11 JOB MIXED INGREDIENTS

A. Water – clean and potable

B. Type I portland cement in compliance with ASTM C150

2.12 ACCESSORIES

A. Sto-Mesh Corner Bead Standard – one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh for outside corner reinforcement

B. Sto Drip Edge Profile - one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh that creates a drip edge and plaster return

C. StoSeal® STPE Sealant - high-movement, low modulus, non-sag one-component silyl-terminated polyether joint sealant in compliance with ASTM C920 and tested in accordance with ASTM C1382

2.13 MIXING

A. Refer to manufacturer's applicable product bulletins for mixing of materials

PART 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Prequalify under Quality Assurance requirements of this specification.

3.2 EXAMINATION

A. Inspect concrete and masonry substrates prior to start of application for:

1. Contamination—algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew, or other foreign substances
2. Surface absorption
3. Cracks—measure crack width and record location of cracks
4. Damage and deterioration such as voids, honeycombs and spalls
5. Moisture content and moisture damage—use a moisture meter to determine if the surface is dry enough to receive the products and record any areas of moisture damage
6. Compliance with specification tolerances—record areas that are out of tolerance (greater than ¼ inch in 10 feet deviation in plane)

B. Inspect sheathing application for compliance with applicable requirement and installation in conformance with specification and manufacturer requirements:

1. Exterior Grade and Exposure I wood based sheathing – APA Engineered Wood Association E 30
2. Attachment into structural supports with adjoining sheets abutted (gapped if wood-based sheathing) and fasteners at required spacing to resist design wind pressures as determined by design professional
3. Fasteners seated flush with sheathing surface and not over-driven

C. Report deviations from the requirements of project specifications or other conditions that might adversely affect the air and water-resistive barrier or the EIFS installation to the General Contractor. Do not start work until deviations are corrected.

3.3 SURFACE PREPARATION

A. Remove surface contaminants on concrete, concrete masonry, gypsum sheathing, or coated gypsum sheathing surfaces

B. Repair cracks, spalls or damage in concrete and concrete masonry surfaces, and level concrete and masonry surfaces to comply with required tolerances

C. Apply conditioner (consult Sto) by spray or roller to chalking or excessively absorptive surfaces or pressure wash to remove surface chalkiness

D. Remove fasteners that are not anchored into supporting construction and seal holes with air and water-resistive barrier detail material

E. Seal over-driven fasteners with Sto air and water-resistive barrier detail material and install additional fasteners as needed to comply with fastener spacing requirement

F. Fill large gaps between sheathing or voids around pipe, conduit, scupper, and similar penetrations with foam adhesive and shave flush with surface (refer to Sto Details)

G. Replace weather-damaged sheathing and repair or replace damaged or cracked sheathing

3.4 INSTALLATION

A. Install manufacturer's air and water-resistive barrier in conformance with manufacturer's written instructions

B. Install manufacturer's EIFS cladding in conformance with manufacturer's written instructions

3.5 PROTECTION

A. Provide protection of installed materials from water infiltration into or behind them

B. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry

3.6 CLEANING, REPAIR AND MAINTENANCE

A. Clean and maintain the EIFS for a fresh appearance and to prevent water entry into and behind the system. Repair cracks, impact damage, spalls or delamination promptly.

B. Maintain adjacent components of construction such as sealants, windows, doors, and flashing, to prevent water entry into or behind the EIFS and anywhere into the wall assembly

C. Refer to Sto reStore Repair and Maintenance Guide (reStore Program) for detailed information on restoration – cleaning, repairs, recoating, resurfacing and refinishing, or re-cladding

Appendix: StoTherm ci GPS Cladding Components

Table 1. StoTherm ci GPS Cladding Components with Sto Textured Finishes listed in ICC ESR-1748

Adhesive	Continuous Insulation	Base Coats	Reinforcing Meshes	Textured Finishes
Sto TurboStick	Sto GPS Board[1,2]	Sto BTS Plus Sto BTS Xtra Sto BTS Silo[3] Sto RFP	Sto Detail Mesh Sto Mesh 6oz Sto Intermediate Mesh	Stolit Lotusan

1. NFPA 285 compliant with up to 12 inches (305mm) thick of Sto GPS Board. Refer to ICC ESR-1748, Table 4. StoArmat Classic Plus base coat with Stolit finish is compliant with NFPA 285. Listing of Sto Armat Classic Plus in ICC ESR-1748 with Stolit (Table 1 in ICC ESR-1748) for use on noncombustible construction is pending.
2. Fire resistance-rated assemblies evaluated and compliant with up to 6 inches (102mm) thick of Sto GPS Board except for systems which use Stolit S and Sto TurboStick or Sto TurboStick Mini adhesive. Refer to ICC ESR-1748, Table 5. Listing of StoArmat Classic Plus in ICC ESR-1748 for fire-resistance rated assemblies (Table 4 in ICC ESR-1748) is pending.
3. Sto BTS Silo is not recognized for use with Stolit Milano and Stolit S finishes.

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. TPO Thermoplastic Single-Ply Roofing.

B. Membrane Flashings.

C. Metal Flashings.

D. Roof Insulation.

1.2 Related Sections:

A. Division 7 Section “Sheet Metal Flashing and Trim” for gutters and downspouts.

1.3 DESIGN CRITERIA

A. Wind Uplift Performance:
   1. Carlisle offers a standard 55 mph wind speed warranty. Please contact Carlisle if a higher wind speed warranty is desired.

B. Thermal Performance: Roof system will achieve a minimum R value not less than 30.

C. Drainage: Provide a roof system with positive drainage where all standing water dissipates within 48 hours after precipitation ends.

D. Building Codes:
   1. Roof system will meet the requirements of all federal, state and local code bodies having jurisdiction.

1.4 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. Installation methods.

B. Detail Drawings:
   1. Submit approved plan, section, elevation or isometric drawings which detail the appropriate methods for all flashing conditions found on the project.
   2. Coordinate approved drawings with locations found on the Contract Drawings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of twenty (20) years experience.

B. Installer Qualifications:
   1. All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation, installation techniques and workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

C. Safety Data Sheets (SDS) must be on location at all times during the transportation, storage and application of materials.

D. When loading materials onto the roof, the Carlisle Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.

1.7 PROJECT CONDITIONS

A. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.

B. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.

C. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.

D. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

E. New roofing shall be complete and weather tight at the end of the work day.

F. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.8 WARRANTY

A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's Total System warranty, outlining its terms, conditions, and exclusions from coverage.
   1. Duration: 20 Years.
   2. Coverage to be extended to include accidental punctures in accordance with terms stated in the Warranty document.
   3. Coverage to be extended to include roof edge metal water tightness in accordance

with terms stated in the Warranty document.

B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

PART 2 PRODUCTS

2.1 Fabric-Reinforced Thermoplastic Polyolefin Sheet: 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. Carlisle SynTec Incorporated. (Basis of Design)

B. Elevate (formally Firestone).

C. GAF Materials Corporation.

D. Johns Manville.

E. Or equal.

2.2 APPLICATION

A. Roof System: Provide a waterproof roof system, capable of withstanding uplift forces as specified in the Design Criteria article of this section.
1. Membrane Attachment: Mechanically Attached.

B. Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.

2.3 INSULATION

A. Carlisle SecurShield Polyisocyanurate:
1. A foam core insulation board covered on both sides with a coated glass fiber mat facer meeting ASTM C 1289-06, Type II, Class 2, Grade 2 (20 psi).
2. Thickness: 4” minimum for average R22 using LTTR values determined in accordance with ASTM C1289.
3. Install in multiple layers when thickness exceeds 1-1/2 inches.
4. Tapered panels shall be factory cut to provide required slopes and installed over base layer.
5. The product is available in 4’ x 8’ standard size with a thickness from 1 to 4 inches. 4’ x 4’ tapered panels are also available.

2.4 THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE

A. Sure-Weld Membrane:
1. Color: White.
2. Membrane Thickness: 80 mil nominal.
a. Thickness over Scrim: 0.034 inches (0.86408 mm).
b. Breaking Strength (ASTM D 751): 350 lbf/in minimum.
c. Tear Resistance (ASTM D 751): 55 lbf/in minimum.
d. Elongation (ASTM D 751): 25 percent.

2.5 FLASHING ACCESSORIES

A. Inside Corners: Pre-molded corner flashing for inside corners. 60 mil thickness. Color to match membrane. Special colors require custom fabrication process.

B. Outside Corners: Injection molded corner used for flashing outside corners. 60 mil thickness. Color to match membrane. Special colors require custom fabrication process.

C. TPO T-Joint Covers: Injection molded 60 mil thick TPO formed into a 4.5 inch (114 mm) diameter circle used to seal step-offs at splice intersections. Color to match membrane. Special colors require custom fabrication process.

D. TPO Universal Corners: A pre-molded flashing for use in a variety of corner details, including inside and outside corners. Available in white, gray and tan and are 60-mil thick.

E. Molded Pipe Seals: A pre-molded flashing and clamping ring used for pipe penetrations. Available for 0.75 inch to 8 inch (19 - 203.2 mm) diameter pipes. Color to match membrane. Special colors not available.

F. TPO Split Pipe Seals: Pre-fabricated flashing consisting of 60 mil thick reinforced Detail Membrane for pipes 1 inch to 6 inch (25.4 - 152.4 mm) in diameter. A split (cut) and overlapped tab is incorporated to allow the pipe seal to be opened and wrapped around the pipe when it is not possible to pull a standard pipe flashing over a round penetration. Gray, tan and special colors require custom order fabrication. Custom sizes available on a special order basis.

G. TPO Split Square Tubing Wraps: Pre-fabricated flashings made of 60 mil thick reinforced Detail membrane for square tubing. A split (cut) and overlap tab are incorporated into these parts to allow the seals to be opened and wrapped around a square tubing penetration with an obstruction. Stock sizes include 3- inch, 4-inch, 5-inch and 6 inch (76, 102, 127, 152 mm) diameter square tubing. Gray, tan and special colors require custom order fabrication. Custom sizes available on a special order basis.

H. TPO Molded Sealant Pockets:
   1. A two-piece, interlocking injection molded, flexible pocket with a rigid polypropylene vertical wall and pre-formed deck flanges. Color to match membrane. Special colors not available.
   2. Used with Thermoplastic One-Part Pourable Sealer as specified in this section for waterproofing pipe clusters or other odd shaped penetrations. The removable built-in extension legs allow the oval pocket to adjust from 7.5 inches to 11.5 inches (191mm - 292 mm) in length while maintaining a 6-inch width (152 mm).

I. Pre-Fabricated Sealant Pockets: A two-piece, pre-fabricated, custom sized, sealant pocket that utilizes reinforced TPO membrane and coated metal to form a rigid, oversized sealant pocket with a weldable horizontal deck flange. Color - White. Gray, tan and special colors require custom order fabrication.

J. Pressure-Sensitive Cover Strip: A nominal 6 inch (152 mm) wide by 40 mil thick non-reinforced TPO membrane laminated to nominal 35-mil thick cured synthetic rubber pressure-sensitive adhesive. Used in conjunction with TPO Primer to strip in flat metal flanges (i.e., drip edges or rows of fasteners and plates). Color to match membrane. Special colors not available.

K. Sure-Weld Heat Weldable Walkway Rolls: Superior tear, puncture and weather resistance and designed to protect Sure-Weld membrane in those areas exposed to repetitive foot traffic or other hazards. Walkway material may be heat welded to Sure-Weld membrane using an automated heat welder or hand held heat welder. Walkway Rolls are 34 inches (864 mm) wide by 50 feet (15.2 m) long and are nominal 180 mils thick. Color - White, gray and tan.

L. Non-Reinforced Flashing: Non-reinforced TPO flashing is a 60-mil thick non-reinforced TPO based membrane used for detail work where the use of pre-molded or pre-fabricated accessories are not feasible. Color - White, gray and tan. Special colors require lead time and 5,000 square foot minimum.

2.6 CLEANERS, PRIMERS, ADHESIVES AND SEALANTS

A. CAV-GRIP III Low-VOC Aerosol Contact Adhesive/Primer: A low-VOC, methylene chloride-free adhesive that can be used for a variety of applications including: Bonding Sure-Weld membrane to various surfaces, priming unexposed asphalt prior to applying Flexible FAST Adhesive, adhering Sure-Weld TPO membrane, horizontally, for the field of the roof, and for adhering Sure-Weld FleeceBACK and Sure-Weld TPO membrane to vertical walls. Coverage rate is approximately 2,000-2,500 sq. ft. per 40 lb cylinder and 4,000-5,000 sq. ft. per 85 lb cylinder as a primer, in a single-sided application; 750 sq. ft. per 40 lb cylinder and 1,500 sq. ft. per 85 lb cylinder as an adhesive for vertical walls, in a double-sided application; 1,000 sq. ft. per 40 lb cylinder and 2,000 sq. ft. per 85 lb cylinder as an adhesive, horizontally, for the field of the roof, in a double-sided application.

B. Cut Edge Sealant: A medium solids content, free flowing polymeric material designed for sealing cut edges (exposed fabric) of Sure-Weld reinforced membrane.

C. Water Cut-Off Mastic: A one-component, low viscosity, self wetting, Butyl blend mastic used as a compression sealing agent between membrane and applicable substrates.

D. Low VOC Primer: Manufacturer's recommended low VOC primer.

E. Universal Single-Ply Sealant: A 100 percent solids, solvent free, VOC free, one-part polyether sealant that provides a weather tight seal to a variety of building materials. It is used for general caulking such as above termination bars and metal counter flashings and at scupper details. Available in white only.

F. Thermoplastic One-Part Sealant: Single component, moisture curing, elastomeric polyether sealant that is compatible with Carlisle's Thermoplastic membranes. Provides a flexible, durable and long lasting seal around hard-to-flash penetrations in Thermoplastic Roofing Systems.

G. Carlisle Weathered Membrane Cleaner: Clear, solvent-based cleaner used to loosen and remove contaminants from the surface of exposed membrane.

2.7 FASTENING COMPONENTS

A. HP Fastener: Threaded, coated (E-Coat) fastener for use with steel, wood plank or oriented strand board (OSB). For insulation fastening only on TPO Mechanically Fastened Roofing Systems.

B. #15-XP Fasteners: Heavy-duty #15 threaded fastener with a Phillips head for standard TPO

seam fastening (Mechanically Fastened Roofing Systems) and where increased pullout resistance is necessary for steel and wood decks (Fully Adhered Roofing Systems).

C. HD 14-10 Concrete Fastener: A #14 threaded fastener used for minimum 3,000 psi concrete decks.

D. CD-10 Concrete Fastener: A hammer-driven, non-threaded E-Coat fastener for use with structural concrete decks rated 3,000 psi or greater.

E. InsulFast Fasteners: Threaded, #12 fastener with a #3 Phillips head used with 3 inch (76 mm) diameter Insulation Plates. For insulation attachment into steel or wood decks.

F. Pre-Assembled ASAP Fasteners: InsulFast Fastener and pre-assembled 3 inch (76 mm) diameter Plastic Insulation Plate for insulation attachment on adhered and mechanically-fastened roofing systems.

G. HP Term Bar Nail-In: A 1 1/4 inch (32 mm) long expansion anchor with threaded drive pin used for fastening Termination Bar or Seam Fastening Plates to concrete, brick or block walls.

H. Piranha Plates: A 2 3/8 inch (60 mm) diameter metal barbed fastening plate used with Carlisle HP-X, CD-10 or HD 14-10 Fasteners for membrane securement. This plate can be used for insulation securement.

I. Insulation Fastening Plates: A nominal 3 inch (76 mm) diameter metal plate used for insulation attachment in conjunction with the appropriate Carlisle Fastener.

PART 3 EXECUTION

3.1 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.

3.2 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. Do not commence work until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment.

D. A vapor retarder / temporary roof (Carlisle VapAir Seal 725 TR Air and Vapor Barrier/Temporary Roof or Carlisle VapAir Seal MD Air and Vapor Barrier) may be applied to protect the inside of the structure prior to the roof system installation.

3.3 INSULATION - SYSTEM DESIGN

A. Base Layer:

1. Type: Polyisocyanurate InsulBase.
2. Thickness: 2 layers of 2.6”
3. Attachment Method: Mechanically attached

3.4 INSULATION PLACEMENT

A. Install insulation or membrane underlayment in multiple layers over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch (6 mm). Stagger joints both horizontally and vertically if multiple layers are provided.

B. Secure insulation to the substrate with the required mechanical fasteners or insulation adhesive in accordance with the manufacturer's current application guidelines.

C. Do not install wet, damaged or warped insulation boards.

D. Stagger joints in one direction unless joints are to be taped. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). Fill all gaps in excess of 1/4 inch (6 mm) with same insulation material.

E. Wood nailers must be at least 3 1/2 inches (89 mm) wide or 1 inch (25 mm) wider than adjacent metal flange. Thickness must equal that of insulation but not less than 1 inch (25 mm) thickness.

F. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.

G. Do not install any more insulation than will be completely waterproofed each day.

3.5 INSULATION ATTACHMENT

A. Securely attach insulation to the roof deck for Adhered or Mechanically Fastened Roofing Systems. Attachment must have been successfully tested to meet or exceed the calculated uplift pressure required by the International Building Code (ASCE-7) or ANSI/SPRI WD-1.

3.6 MEMBRANE PLACEMENT AND ATTACHMENT (Mechanically Attached)

A. Unroll and position membrane without stretching. Allow the membrane to relax for approximately 1/2 hour prior to attachment. Provide and secure both perimeter and field membrane sheets in accordance with the manufacturer's most current specifications and details.

B. Secure the membrane with the required Carlisle Fasteners and Plates centered over the pre-printed marks approximately 1-1/2 inches from the edge of the membrane sheet.

C. Install adjoining membrane sheets in the same manner in accordance with the manufacturer's current application requirements.

3.7 SEAM WELDING

A. APEEL Protective Film should be removed from within areas that are to be heat-welded together. In areas that do not require heat welding, the APEEL Protective Film can be left in place for up to 90 days.

B. Hot-air weld membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's current guidelines. At all splice intersections, roll the seam with a silicone roller to ensure a continuous hot air welded seam.

C. When utilizing membrane greater than 45-mil thickness, overlay all splice intersections with Sure-Weld T-Joint Cover.

D. Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes).

E. Repair all seam deficiencies the same day they are discovered.

F. Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete. Cut Edge Sealant is not required on vertical splices.

3.8 FLASHING

A. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using Sure-Weld reinforced membrane or prefabricated accessories. Sure-Weld non-reinforced membrane may be used for flashing pipe penetrations, Sealant Pockets, and scuppers, as well as inside and outside corners, when the use of pre-molded or prefabricated accessories is not feasible.

B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

C. APEEL Protective Film should be removed and discarded after the completion of the roof system installation.

3.9 DAILY SEALS

A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.

B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

3.10 CLEAN UP

A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.

B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

3.11 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sheet metal flashing and trim not specifically specified in other sections.
   2. Scupper and Downspouts.

B. Related Sections:
   1. Division 9 Section “Painting” for painting of sheet metal flashing and trim.

1.2 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated 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.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
   1. Identification of material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   4. Details of termination points and assemblies, including fixed points.
   5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
   6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
   7. Details of special conditions.
   8. Details of connections to adjoining work.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that 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.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sheet metal flashing and trim that fails in materials or workmanship within specified warranty period.
   1. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Galvanized Sheet Metal Flashing and Trim:
   1. Fry Reglet Corporation.
   2. Hickman, W. P. Company.
   3. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
   4. Or equal.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.

1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.
2. Minimum 24 Gage of sheet metal.
3. 20 Gage for parapet cap flashing.
4. 16 GA cleats to save time in labor when aliening and installing with screws at 24" OC.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and 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.
      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.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Scupper:
1. Size: Three times the size of roof drains.
2. Opening: Minimum opening height of 4 inches with inlet flow line located 2 inches above low point of adjacent roof.
3. Fabricate from the following materials:
   a. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

B. Downspouts: Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Fabricate from the following materials:
   a. Schedule 40 pipe with custom T-shaded bracket.

C. Pre-cast splash blocks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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, welding rods, 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 and levels indicated. 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. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Coat back side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50

percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

G. Flashing corners shall be shop fabricated and fully soldered such that corner assemblies are single monolithic units for 18" in all directions from corners.

3.3 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous cleat.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
2. Connect downspouts to underground drainage system indicated.

3.4 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. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Roof curbs.
   2. Roof hatches.

B. Related Sections:
   1. Division 9 Section “Painting” for field finishes.

1.2 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.

D. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
   1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of roof accessories that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Roof Curbs: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. Custom Curb, Inc.
   2. LM Curbs.
   3. ThyCurb; Div. of Thybar Corporation.
   4. Or equal.

B. Roof Hatches and Heat and Smoke Vents: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Bilco Company (The). (Basis of Design)
   2. Babcock-Davis.
   3. Milcor Inc.; a Gibraltar Company.
   4. Nystrom, Inc.
   5. O'Keeffe's Inc.
   6. ThyCurb; Div of Thybar Corporation.
   7. Or equal.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653, G90 coated and mill phosphatized for field painting.
   1. Comply with Division 9 Section “Painting” for field finishes.

B. Steel Shapes: ASTM A 36, hot-dip galvanized to comply with ASTM A 123, unless otherwise indicated.

C. Steel Tube: ASTM A 500, round tube, baked-enamel finished.

D. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123.

E. Galvanized Steel Pipe: ASTM A 53.

2.3 MISCELLANEOUS MATERIALS

A. Glass-Fiber Board Insulation: ASTM C 726, 1 inch thick.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: ASTM C 920, polyurethane 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, and heavy bodied for hooked-type expansion joints with limited movement.

G. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
   1. Material: Galvanized steel sheet, 0.079 inch thick.

a. Finish: Factory prime painted and field painted per Division 9 Section “Painting”.
2. Factory insulate curbs with 1-1/2-inch- thick, cellulosic or glass-fiber board insulation.
3. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
4. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 ROOF HATCHES

A. General: Fabricate roof hatches with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

B. Product: Type S or E depending on size by Bilco or equal.
1. Type: Galvanized 14 gauge paint bond G-90 galvanized steel single (S) or double-leaf (E) lid as indicated on Drawings.
2. Size: As indicated on Drawings but minimum 30 by 37 inches.
3. Cover:
a. 3 inch 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.
b. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
c. Operation of the cover shall not be affected by temperature.
d. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
4. Cover insulation: Shall be fiberglass of 1 inch thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel.
5. Curb: 12 inch in height with integral capflashing, 1 inch fiberboard insulation, fully welded at corners, and 3-1/2 inch mounting flange with 7/16 inch holes provided for securing frame to the roof deck.
6. Curb insulation: Shall be rigid, high-density fiberboard of 1 inch thickness on outside of curb.
7. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
8. Safety Railing System: Manufacturer's standard complete system including rails, clamps, fasteners, safety barrier at railing opening, and all accessories required for a complete installation. Bil-Guard Hatch Rail System or equal.
9. Finish: Comply with Division 9 Section ”Painting”.

2.6 FINISH

A. Galvanized Steel: Field finish per Division 9 Section “Painting”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
   2. Verify dimensions of roof openings for roof accessories.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
   3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Hatch Installation:
   1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
   2. Attach safety railing system to roof hatch curb.
   3. Attach ladder safety post according to manufacturer's written instructions.

3.3 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 9 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, whether indicated on drawings or not, and other openings indicated.

B. Related Sections include the following:
   1. Division 7 Section "Fire-Resistive Joint Systems."
   2. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.2 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
   1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers.
   2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
   1. F-Rated Systems: Provide through-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 the following conditions, provide through-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:
      a. Penetrations located outside wall cavities.
      b. Penetrations located outside fire-resistance-rated shaft enclosures.
   3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 deg F.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

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

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.

E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
   2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
      a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
         1) UL in its "Fire Resistance Directory."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of through-penetration firestop system that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Through-Penetration Firestop Systems: Subject to compliance with requirements, provide one of the through-penetration firestop systems for each application that are produced by one of the following manufacturers.
   1. Hilti, Inc.
   2. Specified Technologies Inc.
   3. 3M; Fire Protection Products Division.
   4. Or equal.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-/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.

C. Caulking, sealants, and adhesives applied on the interior of the building envelope shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. 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 an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
   2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
   3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-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 other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would

otherwise be permanently stained or damaged by such 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.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following 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 so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
   1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Through-penetration firestop system designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Through-penetration firestop system manufacturer's name.
   6. Installer's name.

B. Marking and Identification: Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
   1. Be located in accessible concealed floor, floor-ceiling or attic spaces.
   2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partitions.

3. Include lettering not less than 0.5 inch in height, incorporating the suggest wording: “fire and/or smoke barrier – protect all openings,” or other wording.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-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 that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM LOCATION

A. General: Provide assemblies as indicated on Drawings. For additional locations not identified on Drawings, provide manufacturer’s standard offerings.

B. For penetrations by non combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:
1. Hilti FS 601 Elastomeric Firestop Sealant.
2. Hilti FS ONE High Performance Intumescent Firestop Sealant.
3. 3M Fire Stop Sealant 2000 4. 3M Fire Barrier CP25 WB.
4. Tremco Tremstop Fyre Sil Sealant.
5. Or equal.

C. For penetrations by combustible items (penetrants consumed by high heat flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:
1. Hilti FS ONE High Performance Intumescent Firestop Sealant.
2. Hilti CP 618 Firestop Putty.
3. Hilti CP 642 Firestop Jacket.

4. Hilti CP 643 Firestop Jacket.
5. 3M Fire Barrier CP25 WB.
6. 3M Fire Barrier FS 195 Wrap/Strip.
7. Tremco Tremstop WBM Intumescent Firestop Sealant.
8. Or equal.

D. For penetrations by combustible plastic pipe (open piping systems), the following materials are acceptable:
1. Hilti CP 642 Firestop Jacket.
2. Hilti CP 643 Firestop Jacket.
3. Hilti FS ONE High Performance Intumescent Firestop Sealant.
4. 3M Fire Barrier PPO Plastic Pipe Device.
5. Or equal.

E. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways' the following materials are acceptable:
1. Hilti FS 635 Trowelable Firestop Compound.
2. Hilti FIRE BLOCK.
3. 3M Firestop Foam 2001.
4. 3M Fire Barrier CS 195 Composite Sheet.
5. Or equal.

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fire-resistive joint systems for interruptions to fire rated assemblies, whether indicated on drawings or not, and other openings indicated.

B. Related Sections include the following:
   1. Division 7 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
   2. Division 7 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.
   1. Load-bearing capabilities as determined by evaluation during the time of test.

C. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

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

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
      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 referencing system designations of the qualified testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fire-resistive joint systems that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire-Resistive Joint Systems: Subject to compliance with requirements, provide one of the through-penetration firestop systems for each application that are produced by one of the following manufacturers.
   1. Hilti, Inc.
   2. Specified Technologies Inc.
   3. 3M; Fire Protection Products Division.
   4. Or equal.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.

B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
   1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.

D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM LOCATION

A. For fire rated construction joints and other gaps, the following materials are acceptable:
   1. FS 601 Elastomeric Firestop Sealant by Hilti.
   2. CP 601 s Elastomeric Firestop Sealant by Hilti.
   3. CP 606 Flexible Firestop Sealant by Hilti.
   4. CP 672 Firestop Joint Spray by Hilti.
   5. Firestop Sealant 2000 by 3M.
   6. Tremstop Fyre Sil Sealant by Tremco.
   7. Or equal.

B. For openings between structurally separate sections of wall and floors. Top of walls, the following materials along with Thermafiber Safing are acceptable:
   1. FS 60t Elastomeric Firestop Sealant by Hilti.
   2. CP 601s Elastomeric Firestop Sealant by Hilti.

3. CP 606 Flexible Firestop Sealant. by Hilti
4. FS ONE High Performance Intumescent Firestop Sealant by Hilti.
5. Fire Barrier CP 25 WB by 3M.
6. Or equal.

C. Firestopping at Electrical Boxes and Utility Outlets.
1. CP 618 Firestop Putty Stick by Hilti.
2. CP 617 and CP 617L Firestop Putty Pad by Hilti.
3. Or equal.

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

E. Qualification Data: For Installer.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
   1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years.

B. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

C. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Joint Sealants: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
1. Sika Corporation
2. Pecora Corporation.
3. Bostik.
4. Dow Corning Corp.
5. GE Plastics.
6. Sonneborn Building Products, ChemRex, Inc.
7. Tremco, Inc.
8. The Sherwin-Williams Company.
9. Or equal.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants:
1. As selected by Architect from manufacturer's full range.
2. Areas where concrete joint sealant will be adjacent to concrete other than standard gray, sealant color shall match adjacent color as approved by Architect.

2.3 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, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form-release agents from concrete.
      a. Clean nonporous 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 in writing by joint-sealant manufacturer, based on 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 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type 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.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. 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.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
   4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
   5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
      a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
   1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
   2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
   3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
   4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 CLEANING

A. 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.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT LOCATION

A. General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Products:
      a. SikaFlex 1A or 15LM by Sika Corp.
      b. Dynatrol I-XL by Pecora.
      c. Stampede 1 by The Sherwin-Williams Company.
   2. Color: Standard colors matching finished surfaces.
   3. Applications:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior joints for which no other sealant is indicated.

B. Exterior Metal Lap Joint Sealant: Silicone, Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Products:
      a. SikaSil WS-295 Silicone by Sika Corp.
      b. 895 Silicone or Sil-Span by Pecora.
   2. Color: Standard colors matching finished surfaces.
   3. Applications:
      a. Concealed sealant bead in sheet metal work.
      b. Concealed sealant bead in siding overlaps.

C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.

1. Products:
    a. AC-20 manufactured by Pecora.
    b. 950A manufactured by The Sherwin-Williams Company.
2. Color: Standard colors matching finished surfaces.
3. Applications:
    a. Interior wall and ceiling control joints.
    b. Joints between door and window frames and wall surfaces.
    c. Other interior joints for which no other type of sealant is indicated.

D. Interior Floor Joint Sealant: Polyurethane, chemically-curing, cold-applied, self-leveling elastomeric sealant; ASTM C 920, Grade P, Class 25, Uses T, M and A; two-part.
1. Products:
    a. SikaFlex 2C SL or NS with TG Additive by Sika Corp.
    b. NR-200 self-leveling polyurethane and/or DYNATRED non-sag, traffic-grade polyurethane sealants by Pecora.
    c. Stampede 2SL by The Sherwin-Williams Company.
2. Primer: SikaFlex 429 Primer; P-150, P-75 or P-200.
3. Color: Standard colors matching finished surfaces.
4. Applications: Use for joints up to 1-1/2 inches.
    a. Expansion joints in floors.

E. Concrete Paving Joint Sealant: Polyurethane, chemically-curing, cold-applied, self-leveling elastomeric sealant; ASTM C 920, Class 25, Uses T, I, M and A; two-part.
1. Products:
    a. NR-200 Urexpan and/or DYNATRED non-sag, traffic-grade polyurethane sealant by Pecora or equal.
    b. Stampede 2NS by The Sherwin-Williams Company.
2. Primer: SikaFlex 429 Primer; P-150, P-75 or P-200.
3. Color: Gray or Limestone.
4. Applications:
    a. Joints in sidewalks and vehicular paving.

F. Butyl Sealant: ASTM C 920, Grade NS, Class 12-1/2, Uses NT, M, A, G, O; single component, solvent release, non-skinning, non-sagging.
1. Products:
    a. BC-158 sealant by Pecora.
    b. WL Silicone Rubber by The Sherwin-Williams Company.
2. Color: Standard colors matching finished surfaces.
3. Movement Capability: Plus and minus 12-1/2 percent.
4. Service Temperature Range: -13 to 180 degrees F.
5. Shore A Hardness Range: 10 to 30.

G. Silicone Sealant: ASTM C 920, Grade NS, Class 25, Uses NT, A, G, M, O; single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding.
1. Products:
    a. SikaSil WS 290 or WS 295 by Sika Corp.
    b. 864 LM Architectural silicone or 890 silicone sealant by Pecora.
    c. 790 by Dow Corning Corporation.
    d. WL Silicone Ultra WL09210.
2. Color: Standard colors matching finished surfaces.

3. Movement Capability: Plus and minus 25 percent.
4. Applications:
    a. Interior or exterior for joints 1/8 to 1-1/2 inch wide.
    b. Exterior use at expansion joints in masonry where substantial movement is expected.
    c. Glazing application.

END OF SECTION 079200

SECTION 081113 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standard hollow metal doors and frames.
   2. Hollow metal windows.

B. Related Sections include the following:
   1. Division 8 Section “Door Hardware” for door hardware for hollow metal doors.
   2. Division 9 Section “Painting” for field painting hollow metal doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 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 nonvented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished units.

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.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 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.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel doors and frames that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 5 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Doors and Frames: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Steelcraft; an Ingersoll-Rand company. (Basis of Design).
   2. Ceco Door Products; an Assa Abloy Group company.
   3. Curries Company; an Assa Abloy Group company.
   4. Or equal.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications for interior doors and frames.

B. Galvannealed (Metallic-Coated) Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B; with minimum A60 metallic coating for exterior doors and frames.

C. Frame Anchors: ASTM A 591, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.

E. Powder-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 hollow metal frames of type indicated.

F. Glazing: Comply with requirements in Division 8 Section "Glazing."
   1. Wired glass is not allowed.
   2. Tempered or fire-rated where required.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide 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.
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
      a. Standard Core: Honeycomb, U-factor of 0.69, R-value of 1.45.
      b. Fire Door Core: As required to provide fire-protection indicated.
   3. Vertical Edges for Single-Acting Doors: Beveled edge.
      a. Beveled Edge: 1/8 inch in 2 inches.
   4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
   5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
   6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
   7. Vision, Narrow Lite, Half Glass Doors: Size as indicated on Drawings.

B. Exterior Doors: Face sheets fabricated from galvannealed (metallic-coated) steel sheet. 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. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2:
      a. Face thickness: 14 gage (0.067 inch).
         1) Product: Series L14 by Steelcraft.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless galvanized (metallic-coated) sheet is indicated. 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. Level 3 and Physical Performance Level B (Heavy Duty), Model 2:

a. Face thickness: 14 gage (0.0672 inch).
1) Product: Series L14 by Steelcraft.

2. Fire-Rated Door Assemblies: Assemblies complying with CBC 716.5 Opening Protection Ratings and Markings and 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 UL-10C.
a. Temperature-Rise Limit: Where required, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure per CBC Section 716.5.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frame: 14 gage (0.067-inch) thick steel sheet.
a. Product: F14 Series by Steelcraft.

C. Interior Frames: Fabricated from cold-rolled steel sheet.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded. Knocked down is not allowed.
3. Frame: 14 gage (0.067-inch) thick steel sheet.
a. Product: F14 Series by Steelcraft.
4. Frames for Wood Doors: Same type as for steel doors.
5. Frames for Borrowed Lights: Same as adjacent door frame.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. Provide Screw-In Top Cap for exterior doors.

2.7 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. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances:
   1. Standard doors and frames: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in doors.
   3. Astragals: Provide overlapping astragal 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.

D. Hollow Metal Frames: 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.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. 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.
   3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   6. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. 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.

b. Compression Type: Not less than two anchors in each jamb.

c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 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 nontemplated, 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.

G. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
1. Maximum Rate: 0.3 cfm/sq. ft. of area at an inward test pressure of 1.57 lbf/sq. ft.
2. Maximum Rate: 0.1 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft.

2.8 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
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; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Field-Applied Paint Finish: Comply with Division 9 Section “Painting”.

PART 3 - EXECUTION

3.1 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. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, 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.

3.2 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 squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 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.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable glazing stops located on secure side of opening.
      d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      e. Check plumbness, squareness, and twist of frames as walls are constructed. 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.
      a. Post-installed expansion anchors shall comply with IR 19-1.

b. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

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. Jambs 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.

3.4 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 Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:
   1. Division 8 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
   2. Division 9 Section “Painting” for field applied finishes.

1.2 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.4 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of access doors and frames that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Access Doors and Frames: Subject to compliance with requirements, provide products by one of the following:
   1. Karp Associates Inc.
   2. Acudor.
   3. Milcor Inc.
   4. Nystrom, Inc.
   5. MIFAB.
   6. Or equal.

2.2 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.
   1. ASTM A 123, for galvanizing steel and iron products.
   2. ASTM A 153, for galvanizing steel and iron hardware.

B. Steel Sheet: Cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Factory Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
   2. Field Finish: Factory prime for field painting as specified in Division 9 “Painting”.

2.3 STAINLESS-STEEL MATERIALS

A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

2.4 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Flange Type:
1. Fire-Rated: Model KRP-250 by Karp.
2. Non-Fire-Rated: Model DSC-214M by Karp.
3. Frame shall be 14 gage steel and doors shall be 16 gage steel.
4. Flange: One-piece construction, 3/4 inch wide.
5. Hinge shall be concealed continuous piano hinge.
6. Locks shall be flush and screwdriver operated with stainless steel cam and studs, or shall be key operated cylinder lock with automatic dust shutter.
7. Finish shall be prime coat of rust inhibitive electrostatic powder, baked grey coat.
8. Door Sizes:
   a. As indicated on Drawings.
9. Field Finish: Comply with Division 9 Section “Painting”.

B. Product: UA-SS Series by MIFAB or equal.
1. Description: Multi-purpose access door. It is designed for flush installation into drywall, block or tile, walls and ceilings. Rounded safety corners, concealed hinge, flush with frame fit, a unique white finish, and a 1/4 inch turn back in the door panel for extra rigidity and safety.
2. Material: Stainless Steel Series is 16 gage #304 Stainless Steel door and frame.
3. Finish: #4 brush satin finish.
4. Door: Flush to frame. Turned back around edges for extra rigidity.
5. Frame: Pre-punched mounting holes for simple installation.
6. Hinge: Concealed pivot pins.
7. Latch:
   a. Standard-Flush mounted, screwdriver operated cam.
8. Size: As indicated on Drawings.
9. Use: Wet, damp, and exterior locations.

C. Product: MPFRU-SS Series by MIFAB or equal.
1. Description: Fire rated access door approved by Underwriters Laboratories Inc.
2. Fire Rating: Underwriters Laboratories "B" label. 1-1/2 hours for walls.
3. Material: Stainless steel Series is 16 gauge #304 stainless steel door and frame.
4. Finish: #4 brush satin finish.
5. Door: Flush to frame. Self-closing. Can be opened from the inside or back of the door with unique thumb turn latch.
6. Frame: Four piece welded frame with masonry mounting straps.
7. Hinge: Concealed pivot pins.
8. Spring: Heavy duty.
9. Latch:
   a. Standard: Flush mounted, interchangeable turn ring operator and key operator latch.
10. Size: As indicated on Drawings.
11. Use: Wet, damp, and exterior locations.

2.5 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 panels to types of supports indicated.
   1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.6 FINISHES

A. Field finish per Division 9 Section “Painting”.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Aluminum-framed storefronts.
   2. Manual-swing aluminum doors.

B. Related Sections include the following:
   1. Division 7 Section “EIFS” for flashing windows, door, and other openings.
   2. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
   3. Division 8 Section “Steel Doors and Frames” for windows made of hollow metal frames.
   4. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
   1. Structural loads.
   2. Thermal movements.
   3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   4. Dimensional tolerances of building frame and other adjacent construction.
   5. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferred to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
      d. Noise or vibration created by wind and thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.
      g. Failure of operating units to function properly.

B. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
   2. Seismic Loads: As indicated on Drawings.

C. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.

F. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

H. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings: Comprehensive, completely integrated mockup of aluminum storefronts, framing, sheathing, EIFS, flashings.

D. Sequencing of installation steps.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch lengths of full-size components and showing details of the following:
1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

G. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
   1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

E. Preinstallation Conference: conduct at project site.

F. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Comprehensive, completely integrated mockup of aluminum storefronts, framing, sheathing, EIFS, flashings.
   2. Build mockup of typical wall area as shown on Drawings.
   3. Field testing shall be performed on mockups according to requirements in Part 3 "Field Quality Control" Article.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.6 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water leakage through fixed glazing and framing areas.
      e. Failure of operating components to function properly.
   2. Warranty Period: 2 years.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

C. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Entrance and Storefronts: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Arcadia Inc. (Basis of Design)
   2. Kawneer.
   3. EFCO Corporation.
   4. Oldcastle Building Envelop.
   5. Or equal.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308.
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36.
2. Cold-Rolled Sheet and Strip: ASTM A 1008.
3. Hot-Rolled Sheet and Strip: ASTM A 1011.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

G. Product: AG451 Series by Arcadia or equal.
1. 2” x 4½” Thermal; center glazed, screw spline, shear block, compensating stick or punched opening fabrication for 1” glass.
   a. Max U-factor: 0.41.
   b. Max RSHGC: 0.26.
   c. Min VT: 0.46.
2. Framing Materials and Accessories:
   a. Framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 – Alloy G.S. 10a T6).

b. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc-plated steel in accordance with ASTM.A-164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum.

3. Glazing Gasket:
   a. Compression-type design, replaceable, molded or extruded santoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
   b. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.
4. Fabrication:
   a. Continuous sub-sill shall be provided under sill members to collect water infiltration and divert from the interior of the system.
   b. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements, for hardware attachment, and as indicated.
   c. Fasteners shall be so located as to ensure concealment from view in the final assembly.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.5 DOORS AND FRAMES

A. Product: WS512 Series, Wide Stile Door 1-3/4” by Arcadia.
   1. Vertical Stiles: 5 inches.
   2. Top Rail: 5-1/8 inches.
   3. Bottom Rail: 10-1/2 inches.
   4. Glazing Stops: Square snap-in type.
   5. Glazing: Insulated glazing as specified in Division 8 Section “Glazing”.
   6. Glazing Gasket: Compression-type design.
   7. Major portions of the door stiles a nominal .125 inches and glass stops .050 inches thick.
   8. Door members: Extruded 6063-T6 aluminum alloy (ASTM B221-Alloy G.S. 10a T6).
   9. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc plated steel in accordance with ASTM A-164. Shall be aluminum or steel, providing the steel is properly isolated from aluminum.
   10. Stiles and rails shall be tubular sections accurately joined, flush and hairline at corners with heavy concealed reinforcement brackets secured with machine bolts, with optional MIG weld. Exposed screws not permitted.
   11. Each door leaf equipped with an adjusting mechanism, located in the top rail near the lock stile.

12. Prepare internal reinforcement for door hardware.
13. Weatherstripping: Hard-backed poly pile in door and/or frame. Meeting stile of all pair of doors have a double line hard-backed poly-pile astragal.

B. Door Hardware: Factory hardware and as specified in Division 8 Section "Door Hardware."
1. Door hardware supplier shall be responsible for furnishing physical hardware to the entrance manufacturer prior to fabrication, and for coordinating hardware delivery requirements with the hardware manufacturer, the general contractor and the entrance manufacturer to insure the building project is not delayed. Coordinate master-keyed requirements.

2.6 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Division 7 Section "Building Insulation."

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.

2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Doors: Reinforce doors as required for installing hardware.
1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Hardware Installation:
1. Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
2. Hardware supplier shall furnish hardware to door manufacturer prior to fabrication and coordinate hardware delivery with door manufacturer to insure project is not delayed.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Entrances: Install to produce smooth operation and tight fit at contact points.
1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

G. Install insulation materials as specified in Division 7 Section "Building Insulation."

H. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

I. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:
a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.
1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

END OF SECTION 084113

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.02 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. This Section includes the following, but is not necessarily limited to:

1. Door Hardware, including electric hardware.
2. Storefront and Entrance door hardware.
3. Digital keypad access control devices.
4. Power supplies for electric hardware.
5. Thresholds, gasketing and weather-stripping.
6. Door silencers or mutes.

1.03 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE.)

A. 2022 California Building Code, CCR, Title 24.

B. BHMA – Builders' Hardware Manufacturers Association

C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

D. DHI – Door and Hardware Institute

E. NFPA - National Fire Protection Association.

1. NFPA 80 - Fire Doors and Other Opening Protectives
2. NFPA 105 - Smoke and Draft Control Door Assemblies

F. UL - Underwriters Laboratories.

1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

G. WHI - Warnock Hersey Incorporated

H. SDI - Steel Door Institute

1.04 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 1 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 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 -1)						
			(a) 1 Single Door #1 - Exterior from Corridor 101		(b) 90°	(c) RH
				(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea		(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE
2	6AA	1 ea		Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH

(a) - Single or pair with opening number and location. (b) - Degree of opening (c) - Hand of door(s) (d) - Door and frame dimensions and door thickness. (e) - Label requirements if any. (f) - Door by frame material. (g) - (Optional) Hardware item line #. (h) - Keyset Symbol. (i) - Quantity. (j) - Product description. (k) - Product Number. (l) - Fastenings and other pertinent information. (m) - Hardware finish codes per ANSI A156.18. (n) - Manufacture abbreviation.

D. Make substitution requests in accordance with Division 1. 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.

1.05 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 Standard No. 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.

1.06 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.

1.07 WARRANTY

A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:

1. Mechanical Locksets: Ten (10) years.
2. Closers: Thirty (30) years.
3. Mechanical exit devices: Ten (10) years
4. Electro-mechanical exit devices: Five (5) years
5. All other hardware: Three (3) years.

1.08 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.

1.09 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 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

2.01 MANUFACTURERS

Item	Manufacturer	Acceptable Substitutes
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	Or Approved Equal
Exit Devices	Von Duprin	Or Approved Equal

Closers	LCN	Or Approved Equal
Push, Pulls & Protection Plates	Ives	Trimco
Stops	Ives	Trimco
Thresholds	Pemko	Zero, National Guard
Seals & Bottoms	Pemko	Zero, National Guard

2.02 MATERIALS

A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.

1. 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: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.

2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.

1. 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 Test – 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
2. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
3. UL 10C for 4’-0” x 10’-0” 3-hour fire door.
4. Cylinders: Refer to “KEYING” article, herein.
5. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
6. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
7. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw capable of UL listing of 3 hours on a 4’ x 10’ opening. Provide proper latch throw for UL listing at pairs.
8. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
9. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
10. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
11. Provide wired electrified options as scheduled in the hardware sets.
    a. 12 through 24-volt DC operating capability, auto-detecting
    b. Selectable EL (fail safe)/EU (fail secure) operating mode via switch on chassis

c. 0.230A (230mA) maximum current draw
d. 0.010A (10mA) holding current
e. Modular / “plug in” request to exit switch

12. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

C. Deadlocks: Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of ¼” diameter steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike alloy deadbolt with reinforcer and two 3” long screws. ANSI A156.5, 2001 Grade 1 certified.

D. Exit devices: Von Duprin as scheduled.

1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
3. Mechanism case shall have an average thickness of .140".
4. Compression spring engineering.
5. Non-handed basic device design with center case interchangeable with all functions.
6. All devices shall have quiet return fluid dampeners.
7. All latchbolts shall be deadlocking with ¾” throw and have a self-lubricating coating to reduce friction and wear.
8. Device shall bear UL label for fire and or panic as may be required.
9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
10. Lever Trim: “Breakaway” design, forged brass or bronze escutcheon with a minimum of .130” thickness, match lockset lever design.
11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
12. Furnish glass bead kits for vision lites where required.
13. All Exit Devices to be sex-bolted to the doors.
14. Panic Hardware shall comply with CBC Section 11B.404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
    a. Provide exit devices UL certified to meet maximum 5 pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware.

E. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.

1. Door closer cylinders shall be of high strength cast iron construction with double heat-treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
3. All parallel arm closers shall incorporate one-piece solid forged steel arms with bronze bushings. 1-9/16” steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The

intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
5. Closers shall be installed to permit doors to swing 180 degrees.
6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
7. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.
8. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. 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. Closers on rated doors 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. Per 11B-404.2.8.1, door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.

F. Door Stops:

1. Unless otherwise noted in Hardware Sets, provide floor 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. 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.

G. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.

H. Thresholds: As Scheduled and per details.

1. Thresholds units not less than 4” wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and fit door frames.
2. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
3. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 “Thermal and Moisture Protection”.
4. Use ¼” fasteners, red-head flat-head sleeve anchors (SS/FHSL).
5. Thresholds shall comply with CBC Section 11B-404.2.5.
6. Aluminum thresholds be cut-in, scribed, around mullions, frame members, and stops, not simply butted to them, to provide a continuous surface across the full width of the opening from jamb to jamb.
7. Where aluminum panic-type (rabbeted) thresholds with neoprene inserts are specified, doors must be undercut as required to properly mate with seal in threshold.

I. Seals: Provide continuous gasketing on exterior openings, to the head and jambs, forming a continuous seal between the door and the frame. Provide smoke, light, or sound gasketing on interior doors where indicated.

1. Provide self-tapping fasteners for aluminum extruded gasketing being applied to hollow metal frames. Exterior applications provide non-corrosive fasteners.

a. Provide neoprene, EPDM, silicone, or nylon brush inserts as specified in hardware sets. Provide non brush inserts of solid or sponge cell, as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.

2. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
3. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.
4. Smoke & Draft Control Doors, Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on “S” labeled Positive Pressure door assemblies.
5. Sound-Rated Gasketing: Provide acoustical gasketing to meet Sound Transmission Class (STC) rating required.
6. Meeting-Stile Gasketing: Where indicated provide meeting-stile gasketing that fastens to the meeting stiles forming a continuous seal when doors are closed.
7. Door Sweeps or Shoes: Where indicated, apply to the bottom of the door to close the gap between the door bottom and finished floor or saddle threshold.
   a. Provide solid neoprene, EPDM, silicone, or nylon brush type of seal as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.

8. Automatic Door Bottoms: Where indicated provide concealed automatic door bottoms. Seal shall be closed cell sponge, bulb neoprene, or EPDM type of seal as specified in hardware sets.
9. Rain Drips Provide overhead rain drips for the top jamb or door bottom of outswinging doors that are not covered against 45 degree blowing rain. Bottom rain drips can be combined with a door sweep or shoe but must meet ADA requirements.:

J. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

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.

2.03 KEYING

A. Furnish a Proprietary Schlage masterkey system as directed by the owner or architect. Key system to be designated and combinated 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 owner and/or architect 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. Establish a new masterkey system for this project as directed by the keying schedule.

D. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).

E. Furnish construction keying for doors requiring locking during construction.

F. Furnish all keys with visual key control.

1. Stamp key “Do Not Duplicate”.
2. Stamp (BHMA) key symbol on key.

G. Furnish all cylinders with visual key control.

1. Stamp (BHMA) key symbol on side of cylinder (CKC).

H. 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.
7. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional) or 47-743-XP (PrimusXP) with above.
8. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
9. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.

I. 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 KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional) or 47-743-XP (PrimusXP) with above.
2. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
3. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.

J. 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 CL100PB for use with non-I/C Schlage cylinders.
2. Furnish CL771R for use with FSIC Schlage cylinders.
3. Furnish CL721G for use with SFIC Schlage cylinders.

K. Furnish subscription to Overtur Key Management Software, a cloud based key management system that is SOC2 Type 2 Certified - cyber security compliance framework.

1. Initial Subscription, Level 1,1 year: OVT-KEY-1YNEW-TI

2.04 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.

2.05 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

3.01 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.

C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) 2016 Edition. A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.02 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 the Door and Hardware Institute. Operating hardware will to be located between 34" and 44" AFF.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.

I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.

J. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.

K. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.

L. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer’s technical documentation.

3.03 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.

3.04 HARDWARE LOCATIONS

A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.05 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.

3.06 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 (Mfr.)

IVE	=	Ives	Hinges, Push Pull & Protection Plates, Door Stops, Coat Hooks & Silencers
LCN	=	LCN	Door Closers
PEM	=	Pemko	Seals & Door Bottoms
SCE	=	Schlage Electronics	Electronic Door Components
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
TRI	=	Trimco	Latch Guards
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Mullion Seals

HARDWARE GROUP NO. 01

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	630	IVE
1	EA	ELEC CLASSROOM LOCK	AD-300-CY-70-SI-RHO-P6 12/24 VDC (PROVIDED BY DIVISION 28)	626	SCE
1	EA	LATCH GUARD	1082-6	630	TRM
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	SEALS	BY DOOR/FRAME MFR.		
1	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	THRESHOLD	PER DETAIL		
			POWER SUPPLY - WORK OF DIVISION 28		

HARDWARE GROUP NO. 02

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	630	IVE
1	EA	ELEC CLASSROOM LOCK	AD-300-CY-70-SI-RHO-P6 12/24 VDC (PROVIDED BY DIVISION 28)	626	SCE
1	EA	LATCH GUARD	1082-6	630	TRM
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	THRESHOLD	PER DETAIL		
			POWER SUPPLY - WORK OF DIVISION 28		

HARDWARE GROUP NO. 03

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	630	IVE
1	EA	ELEC OFFICE LOCK	AD-300-CY-50-SI-RHO-P6 12/24 VDC (PROVIDED BY DIVISION 28)	626	SCE
1	EA	LATCH GUARD	1082-6	630	TRM
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	THRESHOLD	PER DETAIL		
			POWER SUPPLY - WORK OF DIVISION 28		

HARDWARE GROUP NO. 04

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	630	IVE
1	EA	ELEC CLASSROOM LOCK	AD-300-CY-70-SI-RHO-P6 12/24 VDC (PROVIDED BY DIVISION 28)	626	SCE
1	EA	LATCH GUARD	1082-6	630	TRM
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	THRESHOLD	PER DETAIL		
			POWER SUPPLY - WORK OF DIVISION 28		

HARDWARE GROUP NO. 05

4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	630	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
2	EA	ELEC PANIC HARDWARE	RX-LC-PA-AX-99-EO	626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993R-50-SI-RHO-P6-LRX 12/24 VDC (PROVIDED BY DIVISION 28)	626	SCE
1	EA	MORTISE CYLINDER	26-091 (FOR KEYED REMOVABLE MULLION)	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	MULLION SEAL	8780NBK PSA (OR BY STOREFRONT MFR.)	BK	ZER
1	EA	SEALS	BY DOOR/FRAME MFR.		
2	EA	DOOR SWEEP	315CN	AL	PEM
1	EA	THRESHOLD	PER DETAIL		
			POWER SUPPLY - WORK OF DIVISION 28		
1	EA		DOOR CONTACT(S) - WORK OF DIVISION 28 (LEAF WITHOUT AD-300)		

HARDWARE GROUP NO. 06

2	EA	HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	630	IVE
1	EA	ELEC CLASSROOM LOCK	AD-300-CY-70-SI-RHO-P6 12/24 VDC (PROVIDED BY DIVISION 28)	626	SCE
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR SHOE	222AV	AL	PEM
1	EA	THRESHOLD	PER DETAIL		
			POWER SUPPLY - WORK OF DIVISION 28		

HARDWARE GROUP NO. 07

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	S88D	DKB	PEM

HARDWARE GROUP NO. 08

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	S88D	DKB	PEM

HARDWARE GROUP NO. 09

2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	ELEC PRIVACY LOCK	AD-300-CY-40-SI-RHO-P6 12/24 VDC (PROVIDED BY DIVISION 28)	626	SCE
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	COAT AND HAT HOOK	572 POWER SUPPLY - WORK OF DIVISION 28	626	IVE

HARDWARE GROUP NO. 10

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	332CR	AL	PEM
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR BOTTOM	434ARL	AL	PEM

HARDWARE GROUP NO. 11

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	S88D	DKB	PEM

HARDWARE GROUP NO. 12

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	S88D	DKB	PEM

HARDWARE GROUP NO. 13

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D RHO	626	SCH
1	EA	FLOOR STOP	FS439	682	IVE
1	EA	SEALS	BY DOOR/FRAME MFR.		
1	EA	DOOR BOTTOM	434ARL	AL	PEM

HARDWARE GROUP NO. 14

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	ND78P6D RHO IS-CRS	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	SEALS	BY DOOR/FRAME MFR.		

HARDWARE GROUP NO. 15

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	ND78P6D RHO IS-CRS	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	S88D	DKB	PEM

HARDWARE GROUP NO. 16

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ADA STOREROOM LOCK	ND81P6D RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 17

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ADA STOREROOM LOCK	ND81P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
3	SET	SEALS	S88D	DKB	PEM

HARDWARE GROUP NO. 18

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	FLOOR STOP	FS439	682	IVE
1	EA	SEALS	BY DOOR/FRAME MFR.		
1	EA	DOOR BOTTOM	434ARL	AL	PEM

HARDWARE GROUP NO. 19

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	S88D	DKB	PEM

HARDWARE GROUP NO. 20

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
3	SET	SEALS	S88D	DKB	PEM

HARDWARE GROUP NO. 21

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	ND78P6D RHO IS-CRS	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	332CR	AL	PEM
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR BOTTOM	434ARL	AL	PEM

HARDWARE GROUP NO. 22

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	ND78P6D RHO IS-CRS	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	332CR	AL	PEM
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR BOTTOM	434ARL	AL	PEM

HARDWARE GROUP NO. 23

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	ND78P6D RHO IS-CRS	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	332CR	AL	PEM
1	SET	SEALS	S88D	DKB	PEM
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR BOTTOM	434ARL	AL	PEM

HARDWARE GROUP NO. 24

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	332CR	AL	PEM
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR BOTTOM	434ARL	AL	PEM

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows and doors.

1.2 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

C. Qualification Data: For installers.

D. Product Test Reports: For each types of glazing products specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations

with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain glazing products through one source from a single manufacturer for each glass type as practical.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
   1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

F. Safety Glazing Products: Comply with requirements in CBC Section 2406.1.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the manufacturer acceptable to authorities having jurisdiction, in compliance with CBC Section 2406.3.
   2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications:
      a. GANA's "Glazing Manual."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Fire-Rated Glass Manufacturers: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Vitro (formerly PPG). (Basis of Design)
   2. Guardian.
   3. Pilkington.
   4. AGC.
   5. Or equal.

B. Non-Fire-Rated Glazing Fabricators: Subject to compliance with requirements, provide either the named fabricator or an equal fabricator by one of the other fabricators specified.
   1. Viracon. (Basis of Design)
   2. AGC.
   3. Guardian.
   4. Or equal.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass (Safety Glass): ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
   1. For uncoated glass, comply with requirements for Condition A.
   2. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
   3. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
      a. Class II tempered safety glazing per CBC 2406.3 and Table 2406.2(1).

B. Tinted Insulating-Glass Units: Low-e with glass to elastomer edge seal. Outer pane of tinted solar gray glass, inner pane of clear glass. Place reflective coating on No.2 surface within the unit.
   1. Product: Solarban 90 (2) Optigray + Clear, Low-e by Vitro Architectural Glass or equal (Basis of Design).
      a. Visible Light Transmittance (VLT): 36.
      b. Visible Light Reflectance:
         1) Exterior: 8%.
         2) Interior: 19 %.
      c. NFRC U-Value:
         1) Winter Nighttime: 0.29.

d. Solar Heat Gain Coefficient (SHGC): 0.20.
e. Light to Solar Gain (LSG): 1.80.
2. Overall Unit Thickness and Thickness of Each Lite: 1 and 1/4 inch.
3. Interspace Content: Air.
4. Outdoor Lite: Class 1 (tinted solar gray) HS glass.
5. Indoor Lite: Class 1 (clear) HS glass.
6. Tempered glass where required.

C. Laminated acoustic glass:
1. Inner Pane: Specified annealed float glass, Class 1 clear, 1/4 inch (6 mm) thick.
2. Interlayer: Clear, 0.060-inch (1.5 mm) thick PVB.
3. Outer Pane: Specified annealed float glass, Class 1 clear, 1/4 inch (6 mm) thick.
4. Acoustical Properties: STC value of 39.
5. Nominal Overall Unit Thickness: 1/2 inch (13.5 mm).

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant where indicated.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092216 - NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:
   1. Interior suspension systems.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Deflection track: List location of use.

C. Certification of Materials: For steel framing materials.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in 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. Construction Standards: Construction not on Drawings or referenced shall be as detailed in Technical Library by SSMA Technical Services.

D. Deflection Limits: Maximum deflection of following at 5 psf.
   1. Gypsum board assemblies: L/240.
   2. Ceramic tile: L/360.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of non-load bearing steel framing that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Load-Bearing Steel Framing: Subject to compliance with requirements, provide products by one of the following manufacturers.
   1. California Expanded Metal Products Company (CEMCO).
   2. Clark Dietrich.
   3. Dale/Incor.
   4. Western Metal Lath & Steel Framing Systems.
   5. Or equal.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 18 gage minimum.

B. Wire Hangers: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 inch (12 gage) diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (16 gage) and minimum 1/2-inch- wide flanges.
   1. Depth: As indicated on Drawings, but not less than 1-1/2 inch.

D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Depth: As indicated on Drawings.
   2. Minimum Base Metal Thickness: As indicated on Drawings, but not less than 0.0296 thick (20 gage).

E. Resilient Furring Channels: 1/2-inch deep members designed to reduce sound transmission.
   1. Leg Configuration: As indicated on Drawings.
   2. Minimum Base Metal Thickness: As indicated on Drawings, but not less than 0.0296 thick (20 gage).

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
   2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.

B. Related Sections include the following:
   1. Division 9 Section "Tiling" for tile backer board installed as substrates for ceramic tile.
   2. Division 9 Section “Painting” for primers and finishes applied to gypsum board surfaces.

1.2 SUBMITTALS

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

B. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Finishes: Level 4 and 5 of gypsum board finish indicated for use in exposed locations. 4 by 4 foot sample.
      a. Finishes: For each finish indicated and on same backing indicated for Work.

1.3 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each finish indicated.
      c. Each areas such as walls, ceilings, and soffits.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are 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.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gypsum board that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 10 years.

B. Installer’s Warranty: 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Interior Gypsum Board: Subject to compliance with requirements, provide products by one of the following:
   1. Georgia Pacific. (Basis of Design)
   2. National Gypsum Company.
   3. USG Corporation.
   4. Or equal.

B. Steel Trim Accessories: Subject to compliance with requirements, provide products by one of the following:
   1. USG Corporation.
   2. Amico.
   3. Or equal.

2.2 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X:
   1. Thickness: 5/8 inch for new work.
   2. Long Edges: Tapered.
   3. Products:
      a. Toughrock Fireguard X by Georgia Pacific.
      b. Type X by USG.
      c. Or equal.

C. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Use: Toilet rooms and janitor's closets walls with painted finish.
      a. DensArmor Interior Guard by Georgia Pacific.
      b. USG Mold Tough Firecode Core Gypsum Panels by USG.
      c. XP Wallboard by National Gypsum.
      d. Or equal.

2.4 TRIM ACCESSORIES

A. Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim and Reveal: As specified in Division 9 Section "Portland Cement Plaster".

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Sealants shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Acoustical Sealant: Sheetrock Acoustical Sealant by USG or equal.
   1. Sealants shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

D. Thermal and Acoustical Insulation: As specified in Division 7 Section "Building Insulation."

E. Gypsum Board Adhesives:
   1. High performance latex-based construction adhesive designed for gypsum board applications.
   2. Adhesives shall comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.
   3. Products:
      a. Green Series SW-325 Shear & Drywall Adhesive by OSI.
      b. Drywall Adhesive GDWA by Grabberman.
      c. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. 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.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. 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.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), 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. 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- to 3/8-inch- wide joints to install sealant.

G. 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.

H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges.
   3. L-Bead: Use where indicated.
   4. U-Bead: Use at exposed panel edges.
   5. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Comply with GA 214 for Level definitions.
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for ceramic tile or acoustical tile.
   3. Level 3: Where indicated on Drawings.
   4. Level 4: At panel surfaces that will be exposed to view with flat paint finish.
      a. Primer and its application to surfaces are specified in other Division 9 Sections.
   5. Level 5: At panel surfaces that will be exposed to view with non-flat paint finish.
      a. Primer and its application to surfaces are specified in other Division 9 Sections.

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 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Acoustical panels and suspension systems for ceilings.

1.2 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.3 SYSTEM DESCRIPTION

A. DSA Interpretation of Regulations (IR) Document Metal Suspension Systems for Lay In Panel Ceilings (IR25-2).
   1. Applies to ceiling systems whose total weight, including air conditioning grilles and light fixtures, does not exceed four (4) psf. Heavier systems and those supporting lateral loads from partitions will require special design details.
   2. 12 ga. minimum hanger wires may be used for up to and including 4'-0" x 4'-0" grid spacing and shall be attached to main runners.
   3. Provide 12 ga. hanger wires at the ends of all main and cross runners within eight inches of the support or within 1/4 of the length of the end tee, whichever is least, for the perimeter of the ceiling area. End connections for runners which are designed and detailed to resist the applied vertical and horizontal forces may be used in lieu of the 12 ga. Hanger wires, subject to Division of the State Architect (DSA) review and approval.
   4. Provide trapeze or other supplementary support members at obstructions to typical hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of plumb are to have countersloping wires.
   5. Ceiling grid members may be attached to not more than 2 adjacent walls. Ceiling grid members shall be at least 3/4 inch free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and a minimum of 3/4 inch clear of wall.
   6. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut or a 16 ga. wire with a positive mechanical connection to the

runner may be used. Where the perpendicular distance from the wall to the first parallel runner is 12 inch or less, this interlock is not required.

7. Provide bracing assemblies consisting of a compression strut and four 12 ga. Splayed bracing wires oriented 90 degrees from each other (see Figure 1) at the following spacing:
   a. Design compression strut per AISC EQ. 2.2.
   b. For school buildings, place bracing assemblies at a spacing not more than 12 by 12 feet on center.
   c. For Essential Services Buildings, place bracing assemblies not more than 8 by 12 feet on center.
   d. Provide bracing assemblies at locations not more than 1/2 the spacings given above, from each perimeter wall and at the edge of vertical ceiling offsets. The slope of these wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut. Splices in bracing wires are not to be permitted without special DSA approval.
   e. Suspended acoustical ceiling systems with a ceiling area of 144 square feet or less, and fire rated suspended acoustical ceiling systems with a ceiling area of 96 square feet or less, surrounded by walls which connect directly to the structure above, do not require bracing assemblies when attached to two adjacent walls.
8. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.
   a. Wire turns made by machine where both strands have been deformed or bent in wrapping can waive the 1-1/2 inch requirement, but the number of turns should be maintained, and be as tight as possible.
9. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding 3/4 inch nominal diameter, to hanger wires using connectors acceptable to DSA.
10. When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for hanger wires, 1 out of 10 must be field tested for 200 lbs. in tension. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 must be field tested for 440 lbs. in tension. Shot-in anchors in concrete are not permitted for bracing wires. If any shot-in or drilled-in anchor fails.
    a. Drilled-in or shot-in anchors require special DSA approval when used in prestressed concrete.
11. Attach all light fixtures and ceiling mounted air terminals or services, to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures. Screws or approved fasteners are required.
12. Flush or recessed light fixtures weighing less than 56 lbs., and air terminals or services, weighing less than 20 lbs may be supported directly on the runners of a heavy duty grid system but, in addition, they must have a minimum of two 12 ga. slack safety wires attached to the fixture at diagonal corners and anchored to the structure above. All 4 x 4 feet light fixtures must have slack safety wires at each corner.
    a. All flush or recessed light fixtures weighing 56 lbs. and air terminals or services, weighing 20 lbs or more must be independently supported by not less than four (4) taut 12 ga. wires each attached to the fixture and to the structure above regardless of the type of ceiling grid system used.
    b. The 4 taut 12 ga. Wires including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.

13. All fixtures and air terminals or services supported on intermediate duty grid systems must be independently supported by not less than 4 taut 12 ga. wires each attached to the fixture or terminal, and to the structure above.
14. Support surface mounted light fixtures by at least two positive devices which surround the ceiling runner and which are each supported from the structure above by a 12 ga. wire. Spring clips or clamps that connect only to the runner are not acceptable.
    a. Provide additional supports when light fixtures are 8’-0" or longer.
15. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting 4 times the weight of the fixture. A bracing assembly per Figure 1, is required where the pendant hanger penetrates the ceiling. Special details are required to attach the pendant hanger to the bracing assembly to transmit horizontal forces.
16. Additional Requirements for Metal Panels. Metal panels and panels weighing more than 1/2 psf, other than acoustical tile, are to be positively attached to the ceiling suspension runners.

B. Structural Performance:
1. Heavy Duty Grid.
2. Minimum 3/4 inch clearance from grid end to wall.
3. Minimum 2 inch perimeter molding or tested 7/8 inch perimeter molding with BERC2 clip by Armstrong.
4. Grid must be attached on 2 adjacent walls, no attachment on other 2 walls.
5. Perimeter T ends tied together at perimeters on tees that are not attached to perimeter molding.
6. Partition attachment bracing is required to be independent from ceiling splay bracing.
7. Seismic separation joint required for areas greater than 2,500 sq. ft. (or full height partitions).
8. Rigid bracing required for ceiling elevation changes.
9. Interior suspended ceilings, soffits, and bulkheads: Maintain deflection of not more than L/360 of distance between supports.

1.4 SUBMITTALS

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

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

E. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.

F. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a. Smoke-Developed Index: 450 or less.
      b. Flame-Spread Classification: CBC 803.
         1) Flame-Spread Rating: Class 1 (0-25).

D. Seismic Loads: Design and size components to withstand seismic loads in accordance with meeting the requirements of ASCE 7 Section 13.5.6.2 as modified by 2022 CBC Section 1617A.1.21.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: 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.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical panel ceilings that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 15 years.

B. Installer’s Warranty: 2 years.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
   2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustical Panels: Provide either Basis of Design product or an equal product by one of the other manufacturers specified, subject to compliance with requirements for manufacturer specific clip and other requirements listed manufacturers.
   1. Armstrong World Industries, Inc. (Basis of Design)
   2. CertainTeed.
   3. Rockfon/Chicago Metallic Corporation.
   4. USG Interiors, Inc.
   5. Hunter Douglas Architectural Products.
   6. BPB- Celotex/CertainTeed.
   7. Tectum Inc.
   8. Or equal.

B. Suspension Systems: Provide either Basis of Design product or an equal product by one of the other manufacturers specified, subject to compliance with requirements for manufacturer specific clip and other requirements listed manufacturers.

1. Armstrong World Industries, Inc. (Basis of Design)
2. CertainTeed.
3. Rockfon/Chicago Metallic Corporation.
4. USG Interiors, Inc.
5. Hunter Douglas Architectural Products.
6. BPB- Celotex/CertainTeed.
7. Or equal.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

2.3 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Fire Performance Class A: ASTM E84 surface burning characteristics.
   1. Flame Spread Index 25 or less.
   2. Smoke Developed Index 50 or less.

B. Products: As indicted on Drawings.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Meeting the requirements of ASCE 7 Section 13.5.6.2 as modified by 2022 CBC Section 1617A.1.21.

D. Wire for Hangers and Ties: Meeting the requirements of ASCE 7 Section 13.5.6.2 as modified by 2022 CBC Section 1617A.1.21.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

J. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

K. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

L. Wall Moldings: Meeting the requirements of ASCE 7 Section 13.5.6.2 as modified by 2022 CBC Section 1617A.1.21.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Product:
1. Commercial quality, CS Type A to ASTM A653, hot-dip galvanized to not less than G30 zinc coating designation.
2. Main Tees and Cross Tees: All suspension main tee and cross tee components are manufactured from commercial quality steel with factory punched cross tee slots, hanger holes and integral bayonet-style end couplings. The main tees are capped with steel capping affixed to a flange and is coated with factory applied baked-on enamel paint.
3. Structural Classification Standard: ASTM C635 Heavy Duty.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

2.7 ACOUSTICAL SEALANT

A. Comply with requirement of Division 7 “Joint Sealants”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 INSTALLATION

A. Install suspension system and panels in accordance with manufacturer’s written instructions.

3.4 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 095113

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Vinyl Composition Tile (VCT).
   2. Resilient wall base and accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements for Resilient Flooring:
   1. Resilient Flooring shall be stable, firm, and slip resistant. CBC Section 11B-302.1.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification:
   1. Full-size units of each color and pattern of resilient floor tile required.
   2. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.

D. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of resilient floor tile that fails in materials or workmanship within specified warranty period.

B. Installer’s Warranty: 1 year.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
   2. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vinyl Composition Tile (VCT): Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Tarkett/Tandus Centiva. (Basis of Design)
   2. Armstrong World Industries, Inc.
   3. Azrock Commercial Flooring, DOMCO.
   4. Congoleum Corporation.
   5. Mannington Commercial, Inc.

6. Or equal.

B. Type TS Resilient Wall Base and Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
1. Roppe. (Basis of Design)
2. Burke Mercer Flooring Products.
3. Flexco.
4. Nora.
5. Or equal.

2.2 VINYL COMPOSITION TILE (VCT)

A. Products: As indicated on Drawings.

2.3 RESILIENT WALL BASE

A. Products: As indicated on Drawings.

2.4 RESILIENT MOLDING ACCESSORY

A. Types:
1. Reducer strip for resilient floor covering
2. Joiner for tile and carpet.

B. Material: Rubber.

C. Profile and Dimensions: As indicated.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed resilient tile and as recommended/ required by the manufacturer for warrantee acceptance or provided by resilient tile manufacturer for the type of carpet being installed.
1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
a. VCT and Asphalt Tile Adhesives: 50 g/L.
b. Cove Base Adhesives: 50 g/L.
c. Rubber Floor Adhesives: 60 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates:
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
   2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.5 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
      a. Use commercially available product acceptable to manufacturer.
   2. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 096519

SECTION 096723 – RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Resinous Flooring.

1.2 SUBMITTALS

A. Product Data: Descriptive data and specific recommendations for surface preparation, mixing, and application of materials.

B. Acceptance Sample: As required by owner, one foot square (1 ft. by 1 ft.) sample of the specified flooring system applied to hardboard or similar backing for rigidity and ease of handling.

C. Maintenance data: Give instructions for general maintenance and repair of surfaces and finishes.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Pre-qualification requirements: Only approved applicators, licensed by manufacturer shall be considered for qualification.
   2. Each approved applicator shall have been qualified by the manufacturer as knowledgeable in all phases of surface preparation.
   3. Each approved applicator must have three (3) years experience of installing resinous flooring systems and submit a list of five projects/references as a prequalification requirement. At least one of the five projects/ references must be of equal size, quantity, and magnitude to this project as a prequalification requirement. Owner has the option to personally inspect the projects/references to accept or reject any of the Contractors prior to bid time as a prequalification requirement.

B. Subcontractor Qualifications:
   1. The only approved and specified subcontractors for this resurfacing work shall be for shot-blast cleaning of the concrete substrate.

C. Acceptance Sample:
   1. Representative sample of the specified flooring system shall be submitted to the Owner prior to the bidding phase of the project. All bidders shall inspect the “acceptance sample” before submitting their bids.
   2. The installed flooring system shall be similar to the acceptance sample in thicknesses of respective film layers, color, texture, overall appearance and finish.

D. Bond Testing: Surface preparation efforts shall be evaluated by conducting Bond Tests at the site prior to application of the flooring system(s).

E. Pre-Job Meeting
   1. Owner requires a Pre-Job Meeting with representatives of Owner, Contractor/Applicator, and Material Manufacturer in attendance. The agenda shall include a review and clarification of this specification, application procedures, quality control, inspection and acceptance criteria, and production schedules.
   2. Applicator is not authorized to proceed until this meeting is held or waived by Owner.

1.4 DELIVERY, STORAGE, AND HADLING

A. All material shall be delivered in original Manufacturer's sealed containers with all pertinent labels intact and legible.

B. Follow all Manufacturer's specific label instructions and prudent safety practices for storage and handling.

1.5 PROJECT / SITE CONDITIONS

A. Material, air, and surface temperatures shall be in the range recommended by resinous flooring manufacturer.

B. Relative humidity in the specific location of the application shall be as recommended by resinous flooring manufacturer.

C. Concrete shall have a moisture emission rate of no more than recommended by resinous flooring manufacturer.

D. Vapor barriers and/or suitable means shall have been installed beneath grade slabs to prevent vapor transmission.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace flooring that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Resinous Flooring:
   1. Dex-O-Tex/Crossfield. (Basis of Design)

2. Polycoat.
3. Stonhard.
4. Key Resin Company.
5. Or equal.

2.2 RESINOUS FLOORING

A. Product: Tek-Crete SL-B-CP Floor by Dex-O-Tex or equal.
   1. Primer: Vapor Control Primer 200.
   2. Self-Screeding Urethane Cement Composition Flooring:
      a. Compressive Strength (ASTM C579): 8,100 psi.
      b. Thermal Distortion (350°F Emersion): Passes.
      c. Tensile Strength (ASTM C307): 1,000 psi.
      d. Flexural Strength (ASTM C580): 2,000 psi.
      e. Thermal Co-Efficient of Thermal Expansion (ASTM C531): 1.5x105.
      f. Density (ASTM C905): 130 lbs/ft3.
      g. Water Absorption (MIL PRF 3134): 0.64%.
      h. Surface Hardness (ASTM D2240): .85- 90 Durometer "D"
      i. Abrasion Resistance (ASTM D1044): 0.0 gr.
      j. Adhesion (ASTM D4541): >400 psi (100% failure in concrete).
      k. Flammability Critical Radiant Flux (ASTM E648): Greater than 1.07 watts/cm2.
      l. Resistance to Fungal Growth (ASTM G21): Passes Rating 1.
   3. High-Abrasion Polyaspartic Topcoat:
      a. Tear strength ASTM D624, Die C: 879 lbs/in.
      b. Flexibility ASTM D1737 180 degree bend, 1/8” mandrel: Passes.
      c. Tensile Strength ASTM D412: 2400 psi.
      d. Tensile Elongation ASTM D412: 100%.
      e. Taber Abrasion ASTM D4060 (CS 17 Wheel, 1000g load: .008 gram loss
      f. 1000 cycles).
      g. Impact resistance, ASTM D2794 direct/reverse: 160 in/lbs. 160 in/lbs.
      h. Hardness ASTM D2240 Shore A: 85-90.
      i. Coefficient of Friction ASTM D2047: 0.67 dry, 0.82 wet. Gloss ASTM D523: 20-40.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where the urethane cement composition flooring is to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.

3.2 Moisture Test: Perform moisture test in conformance with ASTM F 1869 and ASTM F 2170

3.3 SUBSTRATE PREPARATION

A. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.

B. Concrete - Provide a substrate that is free from any curing compounds, sealers, hardeners, grease, oil or any other contaminates. Shot blast (brush blast) or diamond grind substrate to provide an acceptable surface profile for subsequent application.

C. Materials: Mix resin hardener and aggregate as required, and prepare materials according to flooring system manufacturer's instructions.

3.4 FLOOR APPLICATION

A. General: Apply each component of urethane cement composition flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.

B. Body Coat: Over prepared surface, Screed mortar mix at nominal 3/16” – ¼” inch thickness as specified. Allow material flow out and begin to settle. Back roll with a spike roller or looped roller as appropriate to distribute material to a smooth even finish.

C. Cove Base: Apply cove base mix to wall surfaces at locations shown to form cove base height of 4 inches unless otherwise indicated. Follow manufacturer's printed instructions and details including taping, mixing, troweling, and sanding, of cove base.

D. Apply 2 coats of polyaspartic topcoat with nonslip aggregate as approved by Architect.

3.5 CURING, PROTECTION AND CLEANING

A. Cure epoxy resin composition flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

B. Protect finished floor with wax paper. Use Masonite, if rolling load traffic exists.

C. Clean with manufacturer recommended cleaner.

END OF SECTION 096723

SECTION 096816 – SHEET CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes carpeting.

B. Related Sections include the following:
1. Division 9 Section " Resilient Tile Flooring" for resilient wall base and accessories installed with carpet.

1.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements for Carpets:
1. Carpet shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. It shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. Pile height shall be 1/2” maximum. CBC Section 11B-302.2.
2. Exposed edges shall be fastened to floor surfaces and shall have trim on the entire length. Carpet edges shall comply with CBC Section 11B-303. CBC Section 11B-302.2.

1.3 SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:
1. Include concrete moisture and alkalinity limits.
2. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Samples: For each of the following 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- square Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.
3. Carpet Seam: 6-inch Sample.
4. Mitered Carpet Border Seam: 12-inch- square Sample. Show carpet pattern alignment.

C. Product Schedule: For carpet Use same designations indicated on Drawings.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

F. 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.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to DSA.

C. Mockups: Before installing carpet, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to carpet installation including, but not limited to, the following:
1. Review delivery, storage, and handling procedures.
2. Review ambient conditions and ventilation procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, and delamination.
   3. Warranty Period: Life time.

B. Installer’s Warranty: 1 year.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carpet: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Tandus Centiva. (Basis of Design)
   2. Shaw.
   3. Prince Street.
   4. Mohawk.
   5. Patcraft.
   6. Or equal.

2.2 CARPET

A. Products: As indicated on Drawings.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and as

recommended/ required by the manufacturer for warrantee acceptance or provided by carpet manufacturer for the type of carpet being installed.

1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
   a. Total VOCs: 50 g/L

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Substrates:
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
   1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION 096816

SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Wall coverings.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.

C. Samples for Initial Selection: For each type of wall covering indicated.

D. Samples for Verification: Full width by 36-inch- long section of wall covering from lot to be used for each type of wall covering indicated for each color, texture, and pattern required.
   1. Show complete pattern repeat.
   2. Mark top and face of material.

E. Schedule: For wall coverings. Use same designations indicated on Drawings.

F. Maintenance Data: For wall coverings to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide wall coverings and adhesives with the following fire-test-response characteristics as determined by testing identical products applied with identical adhesives to substrates per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Surface-Burning Characteristics: As follows, per ASTM E 84:
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install wall coverings 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.

B. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of wall coverings that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer's Warranty: 1 year.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wall-Covering Material: Full-size units equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vinyl Wall Coverings: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Koroseal. (Basis of Design)
   2. Momentum.
   3. Maharam.
   4. MDC Wallcoverings.
   5. Or equal.

2.2 WALL-COVERING PRODUCTS

A. General: Provide rolls of each type of wall covering from the same run number or dye lot.

B. Products: As indicated on Drawings.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall-covering manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 9 Section "Painting" and recommended in writing by wall-covering manufacturer for intended substrate.

C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.

D. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, dirt, and dust.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity.
3. Metals: If not factory primed, clean and apply metal primer.
4. Gypsum Board: Prime with primer recommended by wall-covering manufacturer.
5. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

G. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

3.3 INSTALLATION

A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

D. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

E. Match pattern 72 inches above the finish floor.

F. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.

G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

H. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 098319 - ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes clip-mounted factory fabricated acoustical wall panels with sound diffusion.

1.2 SUBMITTALS

A. Product Data: Submit standard manufacturer product cutsheet showing product and selected options. Attach index of distinct panels indicating number of like panels, panel size and thickness, edge condition and fabric selection.

B. Design Data / Test Reports: Submit sound absorption coefficients, noise reduction coefficient and sound diffusion coefficients.

C. Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.
   1. Fabric: Full-width by 36-inch- long Sample from dye lot to be used for the Work, and as follows:
      a. With specified treatments applied.
      b. Show complete pattern repeat.
      c. Mark top and face of fabric.
   2. Panel Edge: 12-inch- long Sample showing edge profile, corner, and finish.
   3. Core Material: 12-inch- square Sample showing corner.
   4. Mounting Device: Full-size Sample.
   5. Sample Panels: No larger than 36 by 36 inches. Show joints and mounting methods.

D. Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.3 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.

B. Source Limitations: Obtain acoustical wall panels through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

C. Protect panel edges from crushing and impact.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical wall panels 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.

B. Lighting: Do not install acoustical wall panels until a permanent level of lighting is provided on surfaces to receive acoustical wall panels.

C. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.
2. Warranty Period: 2 years.

B. Installer Warranty: 1 year.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 yards.
   2. Acoustical Wall Panel Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than 5 attachment devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustical Wall Panels: Subject to compliance with requirements, provide either the named product or an equal product by other manufacturers.
   1. Armstrong Industries. (Basis of Design)
   2. Or equal.

2.2 ACOUSTICAL WALL PANELS

A. Product: Tectum Finale Custom Wall Panels by Armstrong World Industries or equal.
   1. Surface Texture: Coarse.
   2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
   3. Custom Finish: Fabric wrapped panels with square fabric-wrapped edges.
      a. Fabric: As indicated on Drawings.
   4. Size: 24” x 48”
   5. Thickness: 1” Tectum + 1” furring.
   6. Edge Profile: edge square.
   7. Noise Reduction Coefficient (NRC): ASTM C 423; 2” NRC 0.95.
   8. Panel Flame Spread: ASTM E 1264; Class A – Fabric is excluded.
   9. Dimensional Stability: HumiGuard Plus.
   10. Sustainable: EPD (Environmental Product Declaration) and HPD (Health Product Declaration).
   11. Attachment: Direct-attach.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, substrates, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Site Verification of Conditions: Commencement of installation constitutes acceptance of prior work.

3.2 PREPARATION

A. Protection: Protect surrounding work so as to avoid damage during installation of Panels.

B. Surface Preparation: Inspect substrate and ensure surface is flat, clean and dry without protruding elements that would otherwise interfere with panel installation.

C. Field Measure: Prior to commencing installation, measure panels and ensure that dimensions correspond to field measured dimensions of installation area.

3.3 INSTALLATION

A. Install panels using metal hook-on system supplied with panels.

B. Install panels so that fabric-covered side with template faces into occupied space. Rectangular panels have no designated top or bottom and may be installed in either direction. Refer to architectural drawings for orientation of non-rectangular panels.

C. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

D. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.

E. Match and level fabric pattern and grain among adjacent panels.

F. Installation Tolerances: As follows:
   1. Variation from Level and Plumb: Plus or minus 1/16 inch.
   2. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

A. Following installation, clean fabric on panels with high quality fabric cleaner per manufacturer’s instructions. Test for color fastness on scrap or concealed material.

B. Clip loose threads; remove pills and extraneous materials.

C. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

3.5 PROTECTION

A. After installation, protect panels against dirt, water and contact that would puncture, snag, tear or otherwise damage panel fabric.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.

C. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 098319

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Surface Preparation.
   2. Field application of paints, stains, varnishes, and other coatings.

1.2 SUBMITTALS

A. Product data - Submit product data sheets for each product.

B. Samples:
   1. Submit two painted samples, illustrating selected colors and textures for each color and systems selected with specified coats cascaded.
   2. Submit on suitable backing, 8x10 inch size.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Mockup two (2) area prior to purchasing paint.
   2. Mockup size: As indicated on Drawings.
   3. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

C. Environment Requirements:
   1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.
   2. Do not paint when there is a threat of rain within 24 hours or when surface or air temperatures are at or below 40 degrees.

1.6 WARRANTY

A. Installer Warranty: 1 year.

1.7 EXTRA STOCK

A. Provide following:
   1. Minimum 1 gallon each product in original or new 1 gallon cans.
      a. Color spot each lid.
      b. Identify with formula, location, product and date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Paints: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Sherwin Williams. (Basis of Design)
   2. PPG.
   3. Behr Paint.
   4. Dunn-Edwards.
   5. Vista Paint.
   6. Or equal.

2.2 PAINTS AND COATINGS

A. Ready mixed, except field-catalyzed coatings.

B. Prepare pigments:
   1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogenous coating.
   2. For good flow and brushing properties.
   3. Capable of drying or curing free of streaks or sags.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application. Do not proceed unless substrate is suitable.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent
   3. Interior Wood: 15 percent, measured in accordance with ASTMD4442.
   4. Exterior Wood: 15 percent, measured in accordance with ASTMD4442.

3.2 PREPARATION OF SURFACE

A. General:
   1. Clean all exterior walls and surfaces of loose and scaly paint, dirt, dust, chalk, and other foreign matter by water-blasting using care not to damage substrate followed by hand scraping, sanding or wire brushing after surfaces are dry. Mildew must be treated with household bleach solution and rinsed thoroughly.
   2. Patch, caulk, set protruding nails and repair all surfaces and cracks where necessary with suitable patching materials and smooth off to match adjacent surfaces.
   3. Sand Glossy surfaces to dull surface and remove residue.
   4. Remove mildew from affected surfaces with a solution of Tri-Sodium Phosphate and bleach. Rinse with clean water and allow to dry completely.
   5. Existing surfaces to be recoated shall be thoroughly cleaned and de-glossed by sanding or other means prior to priming and painting. Patched and bare areas shall be spot primed with the same primer as specified for new work.
   6. Rusty metal: Scrape, sand or wire wheel, feathering edges to sound coating. Dust surfaces. Topcoat.
   7. Remove soil and body oils completely from surfaces, including handrails, door edges and posts. Treat with Liquid Sandpaper or Dull-N-Bond.
   8. Remove hardware, accessories, plates, fixtures and similar items not to be finished. Reinstall at completion.
   9. Signage and artwork shall be removed and reinstalled.

B. Concrete Surfaces:
   1. Concrete surfaces shall be dry, clean and free from efflorescence, encrustations and other foreign matter. Any glazed surface shall be slightly roughened or etched. Curing compounds, bond breakers, release agents and other coatings shall be removed with a light sandblast or high pressure power wash.

C. Galvanized Surfaces: Remove all oils and contamination from galvanized surfaces scheduled to be painted by washing with a compliant solvent wash.

D. Ferrous Metal: Remove grease, rust, scale, dirt and dust from ferrous metal surfaces. Primer coat shall be applied not less than 30 minutes, nor more than 3 hours after preparation of surface.

E. Primed Metal: Sand and scrape shop primed metal to remove loose primer and rust. Touch-up bare, abraded and damaged areas with metal primer. Feather edges to make touch-up patches inconspicuous.

F. Wood Surfaces:
1. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot prime knots, pitch streaks and sappy sections with a stain blocking primer where surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs after patching material has fully cured.
2. Wood surfaces with peeling areas are to have edges of broken paint film sanded to a feather edge.
3. Back prime wood trim. Paint tops, bottoms, edges and cut-outs of doors.

G. Plaster Surfaces:
1. Plaster surfaces shall be dry and free from efflorescence, encrustations and foreign matter. Fill cracks, holes and imperfections, smoothing repairs to match adjacent texture. Allow repairs to fully cure before priming.
2. Prime plaster surfaces with specified primer. Caulk all cracks.

H. Preparation of other surfaces shall be performed following specific recommendations of the coating manufacturer.

3.3 PREVIOUSLY COATED SURFACES

A. Maintenance painting will frequently not permit or require complete removal of all old coatings prior to repainting. However, all surface contamination such as oil, grease, loose paint, mill scale dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers must be removed to assure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dull before repainting. Thorough washing with an abrasive cleanser will clean and dull in one operation, or, wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 to 3 square feet. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, complete removal is required per ASTM D4259.

3.4 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved

E. Sand wood surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust particles just prior to applying next coat.

G. Stipple all edges and corners to conceal brush marks.

H. Paint entire trim element with like color. Painting of faces only is unacceptable. Trim surfaces must be wrapped with the trim color and not "faced off" or "Hollywooded".

I. Doors: Paint entire door unless otherwise noted, including door top and bottom edge surfaces.

J. Tinting: Tint each primer a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint primer to match the color of the finish coat, but provide sufficient differences in shade of primer to distinguish each separate coat.

3.5 PROTECTION

A. Protect work of other trades and items not intended to receive paint. Install "wet paint" signs to protect newly painted surfaces.

3.6 CLEANING

A. Protection - Carefully protect areas where work is in progress from damage.
   1. Provide and spread clean drop cloths when and where required to provide the necessary protection.
   2. Immediately clean-up all accidental spatter, spillage, misplaced paint and restore the affected surface to its original condition.

B. Clean-up:
   1. Clean up debris daily per OSHA requirements.
   2. At completion of work, remove all materials, supplies, debris and rubbish and leave each area in a clean, acceptable condition.
   3. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.7 SURFACES TO BE FINISHED

A. Paint all existing exterior finishes and areas affected by work, unless notes otherwise.

B. Do not paint or finish the following items:

1. Items fully factory-finished unless specifically noted.
2. Fire rating labels, equipment serial number and capacity labels.

C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
2. Paint shop primed items occurring in finished areas.

3.8 CRACK FILLERS

A. Crack Fillers: elastomeric coating manufacturers recommended, factory-formulated crack fillers or sealants, including crack filler primers, compatible with substrate and other materials indicated; VOC content complying with limits of authorities having jurisdiction.

B. Primer: Elastomeric coating manufacturer's recommended, factory-formulated, alkali-resistant primer compatible with substrate and other materials indicated; VOC content complying with limits of authorities having jurisdiction.

3.9 PAINT SYSTEMS - EXTERIOR

A. Ferrous Metals, Unprimed, Latex, 3 coat:
1. 1 Coat: All Surface Enamel Primer LX02.
2. 2 Coats: PI WB Alkyd Urethane Semi-Gloss B53.

B. Galvanized Metals, Semi-Gloss, Waterbased Alkyd, 3 coat:
1. 1 Coat: Pro-Cryl Universal Primer B66-310.
2. 2 Coats PI WB Alkyd Urethane Semi-Gloss B53.

C. Wood and Composite Wood, Flat, Opaque, Latex, 3 coat:
1. 1 Coat: A-100 Exterior Latex Primer B42W41.
2. 2 Coats: A-100 Flat A6W851.

D. Wood and Composite Wood, Semi-Gloss, Opaque, Latex, 3 coat
1. 1 Coat: A-100 Exterior Latex Primer B42W41.
2. 2 Coats: PI WB Alkyd Urethane Semi-Gloss B53.

3.10 PAINT SYSTEMS -INTERIOR (NO VOC)

A. Gypsum Board, Latex Egg-Shell:
1. 1 Coat: ProMar 200 Interior Latex Primer B28W2600.
2. 2 Coats: ProMar 200 Interior Latex Egg-Shell B20-2600 Series.

B. Gypsum Board, Acrylic Semi-Gloss Enamel:
1. 1 Coat: ProMar 200 Interior Latex Primer B28W2600.
2. 2 Coats: ProMar 200 Interior Semi-Gloss B31-2600 Series.

C. Wood, Composition Board, Latex Egg-Shell:

1. 1 Coat: ProMar 200 Interior Latex Primer B28W2600.
2. 2 Coats: ProMar 200 Interior Latex Egg-Shell B20-2600 Series.

D. Wood, Acrylic Semi-Gloss Enamel:
1. 1 Coat: ProMar 200 Interior Latex Primer B28W2600.
2. 2 Coats: Pro Industrial Water base Alkyd Urethane Semi-Gloss B53 Series.

E. Metal - Steel, Aluminum, Galvanized, Acrylic Semi-Gloss Enamel:
1. 1 Coat: Pro Industrial ProCryl Primer B66-310 Series.
2. 2 Coats: Pro Industrial Water base Alkyd Urethane Semi-Gloss B53 Series.

3.11 COLORS

A. To be selected by Architect from manufacturer’s full range of colors.

END OF SECTION 099100

SECTION 101100 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Markerboards.
   2. Tackboards.

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of panel joints.
   2. Show location of special-purpose graphics for visual display surfaces.
   3. Include sections of typical trim members.

C. Schedule: List product, size, and type by room numbers.

D. Samples for Initial Selection: For each type of visual display surface indicated and as follows:
   1. Actual sections of face sheet and tack assembly.
   2. Samples of accessories involving color selection.

E. Samples for Verification: For each type of visual display surface indicated and as follows:
   1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
   2. Trim: 6-inch- long sections of each trim profile.
   3. Accessories: Full-size Sample of each type of accessory.

F. Maintenance Data: For visual display surfaces to include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display surfaces and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

B. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing

and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
   2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.6 WARRANTY

A. Special Warranty for Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces become slick or shiny.
      c. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: Life of the building.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Markerboard: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Modular Trim System by Platinum Visual Systems. (Basis of Design).
   2. LCS Markerboard by Claridge Products & Equipment, Inc.
   3. 555 Series, P3 ceramic steel by Polyvision Corporation.
   4. Magnaboard by Chatfield Clarke Co.
   5. A-1 Visual Systems.
   6. Best-Rite.
   7. Or equal.

B. Tackboard: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Forbo. (Basis of Design)
   2. Claridge Products & Equipment, Inc.
   3. Tackboard by Polyvision Corporation.
   4. Chatfield Clarke Co.
   5. Modular Trim System by Platinum Visual Systems.
   6. A-1 Visual Systems.
   7. Platinum Visual Systems.
   8. Or equal.

2.2 MARKERBOARDS

A. Product: Modular Trim System by Platinum Visual Systems.
   1. Size: As indicated on Drawings.
   2. Heavy-duty aluminum extrusions come standard in clear satin anodized.
   3. 2-3/4 inch blade tray with radius corners.
   4. 3/4 inch wide frame.
   5. 72 inch wall standards boards, adjustable in height.
   6. 1 inch maprail is standard with natural cork insert.
   7. Porcelain-on-Steel writing surfaces with a Lifetime Warranty.
   8. 4 color markers and felt eraser.

2.3 TACK BOARD

A. Product: Bulletin Board by Forbo.
   1. Self-healing properties.
   2. Washable finish.
   3. Colors: As selected by Architect from manufacturer’s 12 soft, matte colors.
   4. Low light-reflectance (no-glare)
   5. Anti-bactericidal properties.
   6. Resists cracking, drying & peeling.
   7. Frame: Satin anodized aluminum.

8. Assembly: 1/4" burlap-backed Forbo laminated to 3/8" fiberboard.
9. Complete with installation hardware.
10. Fire Testing: Class B when tested in accordance to ASTME84/NFPA255, Standard Test Method for Surface Burning Characteristics.
11. 10-year warranty.
12. Size: As indicated on Drawings.

2.4 ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated.
   1. Factory-Applied Trim: Manufacturer's standard.

B. Chalktray: Manufacturer's standard, continuous.
   1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

C. Map Rail: Provide the following accessories:
   1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
   2. End Stops: Located at each end of map rail.
   3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of map rail or fraction thereof.
   4. Flag Holder: One for each room.

2.5 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards, unless otherwise indicated.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
   2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
   3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.6 ALUMINUM 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. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine walls and partitions for proper backing for visual display surfaces.

C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and

plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation. Units shall be braced in place to allow curing of adhesive. There shall be no gaps or voids in adhesion and units shall not give when pushed.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

A. Visual Display Boards: Visual Display Boards shall be attached to the wall by spreading adhesive over the entire back of the panel with 1/4 inch notched trowel. Panels shall be braced to provide thorough adhesion to the substrate, and shall exhibit no “sponginess” when pressed.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 101100

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Panel signs (room signs).
2. Building signs.
3. Parking signs.
4. Traffic signs.
5. Signage accessories.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
1. Raised characters shall comply with 2022 CBC Section 11B-703.2.:
a. Depth: It shall be 1/32 inch (0.8 mm) minimum above their background and shall be sans serif uppercase and be duplicated in Braille.
b. Height: It shall be 5/8 inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter “I”. CBC Section 11B-703.2.5.
c. Finish and contrast: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. CBC Section 11B-703.5.1
d. Proportions: It shall be selected from fonts where the width of the uppercase letter “O” is 60 % minimum and 110 % maximum of the height of the uppercase letter “I”. Stroke thickness of the uppercase letter “I” shall be 15 % maximum of the height of the character. CBC Sections 11B-703.2.4.
e. Character Spacing: Spacing between individual tactile characters shall comply with CBC Section 11B-703.2.7 and 11B-703.2.8.
f. Braille: It shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed and rounded shape and shall comply with CBC Table and Figure 11B-703.3.1.
g. Mounting height: A tactile sign shall be located 48” minimum to the baseline of the lowest Braille cells and 60” maximum to the baseline of the highest line of raised characters above the finish floor or ground surface.
h. Mounting location: A tactile sign shall be located on the approach side, as one enters or exits rooms or space, and be reached within 0” of the required clear floor space per CBC Section and Figure 11B -703.4.2 as follows:
1) a clear floor space of 18’ x 18” minimum, centered on the tactile characters, shall be provided beyond the arc of any door swings between the closed position and 45 degree open position.
2) on the wall at the latch side of a single door.
3) on the inactive leaf of a double door with one active leaf.
4) on the wall at the right side of a double door with two active leafs.

5) on the nearest adjacent wall where there is no wall space at the latch side of a single door or no space at the right side of a double door with two active leafs.

2. Visual characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground.
3. Pictograms shall comply with CBC Section 11B-703.6.
4. Symbol of accessibility shall comply with CBC Section 11B-703.7.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
1. Panel Signs: Full-size Samples of each type of sign required.
2. Approved samples will not be returned for installation into Project.

E. Qualification Data: For Installer.

F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

D. All tactile signage must be field inspected after installation per CBC 11B-703.1.1.2.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
   1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signage fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 5 years.

B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Signs: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Best Sign Systems Inc. (Basis of Design)
   2. Apco Graphics Inc.
   3. ASI Sign Systems, Inc.
   4. Curcio Enterprises, Inc.
   5. Mohawk Sign Systems.
   6. Sign A Rama.
   7. Or equal.

B. Exterior Signs: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Gemini, Inc. (Basis of Design)
   2. A.R.K. Ramos Mfg. Co., Inc.
   3. La Haye Bronze.
   4. Metal Arts; Division of L & H Mfg.
   5. Mills Manufacturing. Inc.
   6. Southwell Co.
   7. Or equal.

2.2 PANEL ROOM SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

B. Product: HC300 ADA Sign System by Best Sign Systems.
   1. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished.
   2. No Smoking signs.
   3. Room, Occupancy, Wayfinding Signs: As selected from 4 standard copy size signs.
      a. 4" x 2" with up to 4 characters each.
      b. 6" x 2" with up to 8 characters each.
      c. 8" x 2" with up to 12 characters each.
      d. 10" x 2" with up to 14 characters each.
   4. Toilet Room Signs: As selected from manufacturer's standard.
   5. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.
   6. Material:
      a. 1/4 inch thick (thicker than standard) "MP", acrylic sheet, ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
   7. Copy: Contracted grade 2 Braille all capital letter on tactile sign.
      a. Font and Size: As indicated on Drawings.

2.3 BUILDING SIGN

A. Custom: As indicated on Drawings.

2.4 PARKING/TRAFFIC SIGNS

A. Material: 0.080" porcelain-enameled aluminum unframed signs, screen printed copy.

B. Accessible signs are blue with white symbol.
   1. Text: Symbols of accessibility, accessible direction, etc. as indicated on Drawings.
   2. Text: Stop, Yield, Do Not Enter, etc. as indicated on Drawings.

C. Post: 2 inch diameter, schedule 40 galvanized pipe.

2.5 ACCESSORIES

A. Mounting Methods: Use concealed fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead

expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.6 FINISHES, GENERAL

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 strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
   2. Signs placed on glazed surfaces, backing sign of the same material and color shall be applied on the opposite glazed surface.

B. Wall-Mounted Panel Signs:
   1. Interior Signs on Smooth Substrates:
      a. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.

2. Exterior and Interior Signs on Rough Substrates:
    a. Mechanical Fasteners: Mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
        1) Fastener: Stainless steel screws, tamper-resistant flat head countersink.
        2) Anchors: Suitable for secure attachment to substrate.

C. Parking and Traffic Signs
1. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
2. Install sign level, plumb, and at height indicated.
3. Cap post with galvanized cap.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by District.

END OF SECTION 101400

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Solid Color Reinforced Composite (SCRC) toilet compartments.

B. Related Sections include the following:
   1. Division 10 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.

C. Samples for Initial Selection: For each type of unit indicated.

D. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.4 QUALITY ASSURANCE

A. Accessible Toilet Compartments:
   1. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
   2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be 9” high minimum above the finish floor and 6” deep minimum beyond the compartment side face of the partition, exclusive of partition support members. It shall be 12” high minimum above the finish

floor for children's use. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66" wide.

3. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 48" minimum. CBC Figure 11B-604.8.2.
4. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of toilet compartments that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 year.

B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Solid Color Reinforced Composite (SCRC) Units: Subject to compliance with requirements, provide products by one of the following:
   1. Bobrick Washroom Equipment, Inc. (Basis of Design)
   2. Accu-Tec Manufacturing, Inc.
   3. Accurate Partitions Corporation.
   4. American Sanitary Partition Corporation.
   5. Ampco, Inc.
   6. Bradley Corporation; Mills Partitions.
   7. Or equal.

2.2 SOLID COLOR REINFORCED COMPOSITE (SCRC) UNITS

A. Series: Sierra Series.

B. Model: 1092, overhead-braced.

C. Materials: Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with Bobrick GraffitiOff coating, thermoset and integrally fused into homogenous piece.
   1. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
   2. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure.
   3. Edges: Same color as the surface.
   4. High density polyethylene (HDPE) is not acceptable.

5. Color: As selected by Architect from manufacturer's full range.

D. Fire Resistance:
1. Smoke Developed Index (ASTM E 84): Less than 450.
2. Flame Spread Index (ASTM E 84): Less than 75.
3. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.

E. Performance Requirements:
1. Graffiti Resistance (ASTM D 6578): Passed cleanability test; 5 staining agents.
2. Scratch Resistance (ASTM D 2197): Maximum load value exceeds 10 kilograms.
3. Impact Resistance (ASTM D 2794): Maximum impact force exceeds 30 inch-pounds.

F. Urinal-Screen Style: Wall hung.

G. Stiles: Floor-Anchored stiles furnished with expansion shields and threaded rods.
1. Leveling Devices: 7 gauge, 3/16 inches thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
2. Stile Shoes: One-piece, 22 gauge, 18-8, Type 304 stainless steel, 4 inch height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch or 1 inch stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

H. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge stainless steel with satin finish; 1 inch x 1-1/2 inches x 58 inches high.

I. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable.

J. Hardware:
1. Compliance: Operable with one hand, without tight grasping, pinching, or twisting of the wrist, and force to operate does not exceed five pounds.
2. Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment on inswing doors.
3. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish. Chrome-plated "Zamak". Aluminum, or extruded plastic hardware not acceptable.
4. Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.
   a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb per insert.
5. Clothes Hooks: Projecting no more than 1-1/8 inch from face of door.
6. Hardware Type: Institutional Hardware.
   a. Latching: 14 gauge sliding door latch, 11 gauge keeper; latch slides on a shock-resistant nylon track. Twist-style door latch operation not acceptable.
   b. Hinges: 16 gauge stainless steel, self-closing, 3 section hinges.
   c. Mounting Brackets: 18 gauge stainless steel and extend full height of panel.
      1) U-Channels: Secure panels to stiles.
      2) Angle Brackets: Secure stiles-to-walls and panels-to-walls.

K. Factory shall prep for all accessories to prevent drilling in the field.

L. Signage in all women's stalls to include: "Please do not flush feminine hygiene products down the toilet."

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.
   2. Attach continuous wall brackets securely to walls using stainless steel fasteners spaced maximum 12 inches on center.
   3. Attach panels and pilasters to continuous brackets with one-way sex bolts.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.2 ERECTION TOLERANCES

A. Maximum variation from true position: 1/4 inch. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 1/4 inch.

B. Maximum variation from plumb: 1/8 inch.

3.3 ADJUSTING

A. Hardware Adjustment:
   1. Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation.
   2. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched.
   3. Set hinges all accessible stalls to return to fully closed position.

END OF SECTION 102113

SECTION 102600 – WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Corner guards.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.

B. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated.
   1. Include similar Samples of accent strips and accessories involving color selection.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Wall Guards: 12 inches long. Include examples of joinery, corners, and field splices.

D. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
   2. Warranty Period: 5 years.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Corner Guards: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Koroseal. (Basis of Design)
   2. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   3. Construction Specialties (C/S), Inc.
   4. Balco, Inc.
   5. Pawling Corporation.
   6. Or equal.

2.2 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.
   1. Use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.3 CORNER GUARDS

A. Product: Korogard GS Series Stainless Steel Corner Guard by Koroseal or equal.
   1. Stainless Steel Corner Guards:
      a. Stainless Steel 90°/90° Bullnose 3.5 inch.
      b. Size: As indicated on Drawings.

2.4 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Remove tool and die marks and stretch lines or blend into finish.
   2. 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. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   2. For impact-resistant wall-protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   1. Install impact-resistant wall-protection units in locations and at mounting heights indicated on Drawings.
   2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
      a. Provide anchoring devices to withstand imposed loads.
      b. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean covers.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Toilet accessories.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Elements of Sanitary facilities shall be mounted at locations in compliance with CBC Sections 11B-602 through 11B-612.
   2. Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609.
   3. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:
      a. 1-1/2” between the grab bar and the wall.
      b. 1-1/2” minimum between the grab bar and projecting objects below and at the ends.
      c. 12” minimum between the grab bar and projecting objects above.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace toilet and bath accessories that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toilet and Bath Accessories: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Bobrick Washroom Equipment, Inc. (Basis of Design)
   2. American Specialties, Inc.
   3. Bradley Corporation.
   4. Or equal.

B. Underlavatory Guards: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Handy-Shield by Plumberex Specialty Products, Inc. (Basis of Design)
   2. IPS Corp.
   3. TCI Products.
   4. Truebro, Inc.
   5. Or equal.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.

D. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 TOILET ACCESSORIES

A. As indicated on Drawings.

2.4 UNDERLAVATORY GUARDS

A. Product: Handy-Shield Maxx by Plumberex Specialty Products, Inc. or equal.
   1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
   2. PVC insulator shall be 1/8" thick.
   3. Meets Testing Standard ASTM E 84-07 per IBC Chapter 8.
      a. 25 flame spread.
      b. 450 smoke index.
   4. Surfaces to be soft, smooth, non-absorbent, easy to clean U/V inhibited, antimicrobial, antifungal properties.
   5. Insulator shall have a dual fastening system which consists of fusion bonded Velcro fastener strips for full slit enclosure and tamper resistant, smooth, non-abrasive snap-locking fasteners.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate OFCI items with District.

B. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104400 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Portable fire extinguishers.
   2. Fire-protection cabinets for the following:
      a. Portable fire extinguishers.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
   1. Fire Extinguishers: Include rating and classification.
   2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples for Initial Selection: For fire-protection cabinets with factory-applied color finishes.

C. Samples for Verification: For each type of exposed factory-applied color finish required for fire-protection cabinets, prepared on Samples of size indicated below.
   1. Size: 6 by 6 inches square.

D. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: 6 years.

B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers and Cabinets: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. JL Industries, Inc. (Basis of Design)
   2. Larsen's Manufacturing Company.
   3. Potter Roemer; Div. of Smith Industries, Inc.
   4. Ansul.
   5. Or equal.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B.

B. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick minimum.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet indicated.
   1. Valves: Manufacturer's standard.
   2. Handles and Levers: Manufacturer's standard.
   3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and Title 19 CCR.
   4. Certification Tag: Provide fire extinguisher with valid certification test tag where fire extinguishers are fully charged and ready to be used.

B. Dry Chemical Type: Cast steel tank, with pressure gage.
   1. Class 2A-10B:C, UL rated.
   2. Nominal Capacity: Provide largest capacity fire extinguisher that will fit in the cabinet, but 5 lbs. minimum.
   3. Finish: Baked enamel, red color.

4. Use: General purpose.
5. Products: Cosmic 5E or Galaxy by J.L. Industries.

C. Wet Chemical Type: Cast steel tank, pressurized, including hose and nozzle, with bracket.
1. Class 2A-K.
2. Size 2.5 gal.
3. Finish: Factory baked enamel, red color.
4. Use: At kitchens.

2.4 FIRE-PROTECTION CABINET

A. Product: Ambassador Series by J.L Industries.
1. Cabinet Type: Suitable for fire extinguisher.
2. Mounting: Recessed. Provide Semi-recessed where recessed can’t be provided.
3. Door Style: Vertical Duo Door with tempered safety glass.
4. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   a. Provide manufacturer's standard.
   b. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
5. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
6. Door Lock: Cylinder lock, keyed alike to other cabinets.
7. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
   a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
      1) Location: Applied to cabinet door.
      2) Application Process: Silk-screened.
      3) Orientation: Vertical.

2.5 FABRICATION

A. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

B. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 FINISHES, GENERAL

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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
   1. Color: As selected by Architect from manufacturer’s full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.

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

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated on Drawings.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
   2. Provide inside latch and lock for break-glass panels.

3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

END OF SECTION 104400

SECTION 107500 - FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-mounted flagpoles made from aluminum.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:
   1. Seismic Loads: according to SEI/ASCE 7.
   2. Wind Loads: Wind speed and exposure factor according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."
   3. Base flagpole design on specified flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
   1. Include section, and details of foundation system for ground-mounted flagpoles.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For flagpole assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Include loads, point reactions, and locations for attachment of flagpoles to building's structure.

E. Qualification Data: For qualified professional engineer.

F. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of flagpoles that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Flagpoles: Subject to compliance with requirements, provide products by one of the following:
   1. American Flagpole; a Kearney-National Inc. company. (Basis of Design)
   2. Concord Industries, Inc.
   3. Pole-Tech Company Inc.
   4. Or equal.

2.2 FLAGPOLES

A. Product: IRC (Internal Reinforced with Cam Cleat), Monarch Series by American Flagpole or equal.
   1. Construction:
      a. Aluminum Flagpole Construction Fabricate from seamless, extruded tubing complying with ASTM B 221, alloy 6063-T6, having a tensile strength not less than 30,000 psi with a yield point of 25,000 psi. Heat treat after fabrication to comply with ASTM B 597, temper T6.
      b. Provide cone-tapered flagpoles, per manufacturer’s standard rate of taper.
   2. Assembly Construction: Internal Revolving with Cam Cleat - Rope Halyard - Ground Set Foundation.
   1. Exposed Height of Flagpole: As indicated on Drawings.
   2. Diameter at Base of Flagpole: Provide standard top diameter.
   3. Quantity: As indicated on Drawings.
   4. Mounting:

a. Foundation Tube: Galvanized corrugated steel foundation tube, .0635”-16 Gauge minimum wall thickness, sized to suit flagpole and installation. Provide with 3/16” steel bottom plate and steel centering wedges. Furnish with 3/16 inch support plate, 3/4 inch diameter x 18 in long steel ground lightning spike. Foundation tube will consist of all welded construction.

5. Fittings:
   a. Beacon Finial:
      1) Double, High Intensity LED’s.
      2) 110 V, UL, FM and CSA Listed.
   b. Internal Revolving Truck Assembly: Cast aluminum two-piece enclosed body, revolving, non-fouling design, single aluminum pulley mounted inside hood, stainless steel roller bearings, nylon exit bushing for rope halyard, and threaded aluminum spindle for attachment to top of pole. Poles 50 fee and over will have sealed bearings.
   c. Internal Halyard Cam Cleat System: Provide one (1) complete internal halyard cam cleat rope assembly with plastic coated counterweight and beaded sling assembly. A manually operated cam cleat mechanism will be installed inside the flagpole behind a flush access door having a cylinder lock.
   d. Halyard Flag Snaps: Provide two (2) stainless steel swivel snap hooks with neoprene covers. E. Flash Collar: Provide Spun Aluminum Collar to match flagpole.
6. Finishes:
   a. Metal Finishes, General: Comply with National Association of Architectural Manufacturers’ (NAAMM) “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.
   b. Finish Specifications (Satin, Anodized, and Powder Paint Finishes). Note: Aluminum Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
      1) Anodized Finishes: Provide Class 1 finish complying with AA M32-C22-A41 (Clear Anodized) or AA M32-C22-A42 (Color Anodized Finishes) in thicknesses ranging from 1 to 3 mils.
         a) Anodized - Clear (AA)

2.3 FLAGS

A. USA and California, 30”x48” size, nylon fabric, brass grommets, hemmed edges.

2.4 MISCELLANEOUS MATERIALS

A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

B. Sand: ASTM C 33, fine aggregate.

C. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Division 7 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Place concrete, as specified in Division 3 Section "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 FLAGPOLE INSTALLATION

A. General: Install flagpoles according to Shop Drawings and manufacturer's written instructions.

B. Ground Set: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure. Install flagpole, plumb, in foundation tube.
   1. Foundation Tube: Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

D. Mounting Brackets and Bases: Anchor brackets and bases securely through to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION 107500

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes residential kitchen/breakroom appliances.

B. Related Sections include the following:
   1. Division 22 Sections for plumbing requirements.
   2. Division 26 Sections for electrical requirements.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance.

B. Appliance Schedule: For appliances; use same designations indicated on Schedule.

C. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for each product.

E. Maintenance Data: For each product to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain residential appliances through one source from a single manufacturer.
   1. To the greatest extent possible, provide appliances by a single manufacturer for entire Project.

D. Regulatory Requirements: Comply with provisions of the following product certifications:
   1. NFPA: Provide electrical appliances listed and labeled as defined in California Electrical Code and NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
4. NAECA: Provide residential appliances that comply with NAECA standards.

E. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Operable Parts: Provide controls with forward reach no higher than 48 inches above the floor, horizontal front reach no more than 25 inches, horizontal side reach no more than 24 inches, and that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Range or Cooktop: Provide knee clearance for forward approach of 27 inches high, 30 inches wide, and 11 inches horizontally; toe space clearance of 9 inches high and 17 inches horizontally; with insulated underside of cooktop to prevent burns, shocks, or abrasions. Provide top surface 34 inches above the floor, with controls that do not require reaching across burners.
3. Refrigerator/Freezer: Provide 50 percent of freezer space within 54 inches of the floor.

F. AHAM Standards: Provide appliances that comply with the following AHAM standards:
1. Dishwashers: AHAM DW-DW1.
2. Electric Ranges: AHAM ER-1.
3. Clothes Dryers: AHAM HLD-1.
4. Household Refrigerators: AHAM HRF-1.

G. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.
1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.4 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
1. Warranty Period: As specified in each items but not less than 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

A. Products: As indicated on Drawings.

2.2 FINISHES, GENERAL

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. Stainless-Steel Finish: Provide appliances with manufacturer's standard finish complying with manufacturer's written instructions for surface preparation including ground and polished stainless-steel surfaces for uniform, directionally textured finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to Divisions 22 and 26 for plumbing and electrical requirements.

3.3 CLEANING AND PROTECTION

A. Test each item of residential appliances to verify proper operation. Make necessary adjustments.

B. Verify that accessories required have been furnished and installed.

C. Remove packing material from residential appliances and leave units in clean condition, ready for operation.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 113100

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes following roller window shades:
   1. Manual.
   2. Motorized.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

C. Samples for Initial Selection: For each colored component of each type of shade indicated.
   1. Include similar Samples of accessories involving color selection.

D. Samples for Verification:
   1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
   2. For the following products:
      a. Shade Material: Not less than 3 inches square, with specified treatments applied. Mark face of material.

E. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.

F. Product Certificates: For each type of roller shade, signed by product manufacturer.

G. Qualification Data: For Installer.

H. Product Test Reports: For each type of roller shade.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of roller shade.

J. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
   1. Methods for maintaining roller shades and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
   3. Operating hardware.

1.3 QUALITY ASSURANCE

A. Comply with Title 19, Article 3-08.

B. Installer Qualifications: Fabricator of products.

C. Source Limitations: Obtain roller shades through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and listing approved by CSFM.
   1. Flame-Resistance Ratings: Passes NFPA 701.

E. Product Standard: Provide roller shades complying with WCMA A 100.1.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of roller shades that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Lifetime.

B. Installer’s Warranty: 1 year.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed, but not fewer than 2 units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Roller Shades: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. MechoShade Systems, Inc. (Basis of Design)
   2. Draper Inc.
   3. Silent Gliss USA, Inc.
   4. Hunter Douglas.
   5. Or equal.

2.2 ROLLER SHADES

A. Product: ElectroShade IQ3-DC EDU by MechoShade or equal.

B. Types:
   1. Manually operated shades.
   2. Motorized operated shades.

C. Configuration: Solar shadecloth**.**

D. Solar Shade Cloth:
   1. ThermoVeil 1300 Series basket weave shadecloths in 2 non-directional 2 x 2 basket-weave. Uniform scrim effect at the window wall with appropriate densities for sun control.
   2. Content: 79% vinyl, 21% polyester core.
   3. UV Test 200 sun-fade hours: None
   4. 500 sun-fade hours: 5%.
   5. Openness Factor: ±5%.
   6. Color: Selected from manufacturer's standard colors.

2.3 ACCESSORIES

A. Roller Shade Pocket: For recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings.
   1. Product: 1-1/2” by 6” clear anodized aluminum.
   2. Provide either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.

a. Provide "Vented Pocket" such that there will be a minimum of four 1 inch diameter holes per foot allowing the solar gain to flow above the ceiling line.

3. Pocket Accessories: As indicated on the Drawings.

B. Fascia:

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
5. Notching of Fascia for manual chain shall not be acceptable.

2.4 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
2. Shade Band and Shade Roller Attachment:
   a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch in diameter for manual shades, and less than 2.55 inches for motorize shades are not acceptable.
   b. Provide for positive mechanical engagement with drive / brake mechanism.
   c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
   d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
   e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.5 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design. Fabricate hem as follows:

1. Standard concealed hem bar.

2.6 MANUAL OPERATED SHADES

A. Access and Material Requirements:
   1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
   2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
   3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.
   4. Catch-pin bracket: Required for very large shades or for shades mounted at 25ft or higher. Catch-pin has heavy duty steel pins surrounding the shade roll at the bracket. Catchpin prevents shades to fall in event shade were to come out of the bracket.

B. Manual Operated Chain Drive Hardware and Brackets:
   1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
   2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
   3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
   4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
   5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
   6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
   7. Provide shade hardware constructed of minimum 1/8-inch thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
   8. Drive Bracket / Brake Assembly:
      a. MechoShade Drive Bracket model shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.
      b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch steel pin.
      c. The brake shall be an over-running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. in the stopped position.
      d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.

e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
f. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. minimum breaking strength. Nickel plate chain shall not be accepted.

2.7 MOTORIZED, INTELLIGENT ENCODED ELECTRONIC DRIVE SYSTEM

A. Low Voltage EDU (24 VDC):
1. Basis of Design: MechoShade Systems LLC; ElectroShade IQ3-DC EDU. Tubular, integral DC motor. 24 VDC; temperature Class B, thermally-protected, totally enclosed, maintenance-free. Powered by low voltage power supply connection equipped with disconnect plug assembly furnished with EDU.
2. Audible Noise: 40 dBA measured 3 ft from motor unit, depending on motor torque.
3. Nominal Speed: 10 to 28 RPM. Configurable. Speed managed such that it does not vary due to load/lift capacity.
4. Min. shade opening width 21.5 inch to accommodate narrow windows.
5. Fits in min. 1.79 inch diameter tube to increase lifting capacity and reduce overall hardware footprint.
6. Bult-in 2-way wireless EnOcean communication, 902MHz.
   a. Addressable with up to 8 wireless EnOcean devices (Wireless Daylight Sensors, Wireless Occupancy Sensors, Wireless Self-Powered Rocker Switches, Wireless Multi-Button Keypads - See Paragraph 2.4D).
   b. Supports Hybrid (wireless + wired) 2-way intelligent network with expanded wireless group control capability facilitating wireless group control of motors connected via wireless and serial network control options.
      1) Using MechoShade Power Panels this expands wireless group control range to a maximum of 4080 ft without requiring external repeaters or routers to be installed or wired.
   c. Integrated automation controller eliminating the need for an external device. includes Wireless Controller functionality, including but not limited to:
      1) Management of paired wireless devices i.e., rocker switches, keypads, daylight sensors, and occupancy sensors.
      2) Solar Activated Control Mode.
7. Override Mode: Place motor into Override Mode when local switch commands shade to new position.
   a. Local switch command sources:
      1) Network keypad or other device that serially communicates with EDU and configured to issue override commands as if it were a local switch connected to EDU dry contact inputs.
8. Preventative Maintenance:
   a. Internally monitor important operating parameters to ensure motor and its shade assembly are functioning properly.
   b. Performance Degradation: Provide visual indication via feedback LED and communicate warnings on repetitive basis through its serial port.
   c. Stop shade rotation for parameters of critical concern until reset by trained technician after being serviced.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 129314 - BICYCLE RACKS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the bicycle racks.

1.2 SUBMITTALS

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

B. Samples for Initial Selection: For units with factory-applied color finishes.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Size: Not less than 6-inch- long linear components and 4-inch- square components.

D. Product Schedule: Use same designations indicated on Drawings.

E. Maintenance Data: For site furnishings to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of site furnishing(s) through one source from a single manufacturer.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of site furnishings that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bicycle Racks:
   1. Dero Bike Racks. (Basis of Design)
   2. Belson Outdoors.

3. Saris Cycling Group.
4. Or equal.

2.2 BICYCLE RACKS

A. Product: Ultra Space Saver Single by Dero Bike Racks or equal.
   1. Material:
      a. Hanger is 1" diameter tube with ½" steel rod and retaining disk at each end.
      b. Upright is 2" square tube.
      c. Feet are AISI C3 x 4.1 galvanized steel channel.
      d. Crossbeams are 1.25" sched. 40 galvanized pipe (1.660" OD).
      e. Spacers are 2.375" OD plastic tubes with .218" wall thickness.
   2. Factory Finish Process: After fabrication hot dipped galvanized finish with powder coat.
      a. Sandblast.
      b. Epoxy primer electrostatically applied.
      c. Final thick TGIC polyester powder coat.
      d. Color: As selected by Architect from manufacturer's full range.
   3. Installation: As indicated on Drawings.
   4. Quantity: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

3.3 CLEANING

A. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 129314

SECTION 13 12 30.1 PRE-ENGINEERED MODULAR BUILDING – RESPONSIBILITY MATRIX

Responsibility Matrix

Cordova Villa Elementary School - Modernzation

Modular Buildings

Description	Site Contractor	Modular Contractor	Others	Comments
Division 01 – General Requirements:				
All Work Within the Perimeter of the Modular Building	X	X		Low Voltage, Electronic control and inter control system conduits and boxes by modular contractor, wires and devices by Site Contractor. Interior cross connects, lighting and outlets are the responsibility of the modular contractor
All Work Outside the Perimeter of the Modular Buildings Not Specifically Identified Below	X			
Full-Time Supervision for Modular Crew Onsite		X		Factory Trained Crew.
Temporary Facilities:				
Set-up Staging Area for Modular	X			Location acceptable to District.
Temporary Site Security Fencing	X			
Temporary Power			X	
Permit and Utility Charges for Start-Up and Testing	X			
Temporary Water	X			
Temporary Fire Water	X			
Temporary Dumpster and Toilets	X			
Division 02 – Existing Conditions:				
Site Demo Removal and Excavation	X			
Rough Grading	X			Coordinate with Modular Manufacturer.

Description	Site Contractor	Modular Contractor	Others	Comments
Division 03 – Concrete:				
Design (Geotech Report by Others)		X		
Over-Excavation and Pad Prep with Certified Pad	X			
Surveying and Foundation Staking	X			
Modular Footings and Stem Walls and Crawl Space	X			
Crawl Space Slurry	X			
Foundation Vents and Grills	X	X		Foundation Vents provided by Modular Contractor, Installed by Site Contractor.
Building Mow Strips	X			
Division 05 – Metals:				
Design		X		
Steel Framing		X		
Metal Soffit		X		
Foundation Vent Grates	X	X		Foundation Grates provided by Modular Contractor, Installed by Site Contractor.
Modular Building Flashings and Weep Screens		X		
Modular Gutters and Downspouts		X		Receivers by Site Contractor
DI under Modular Building with Crawl Spaces	X			Drainage by Site Contractor
DI Grates	X			
ADA Modular Building Grab Bars		X		Restroom Grab Bars

Description	Site Contractor	Modular Contractor	Others	Comments
Division 06 – Wood, Plastics, and Composites:				
Wall Framing		X		
Building Insulation		X		
Exterior / Interior Trim		X		
Division 07 – Thermal and Moisture Protection:				
Gutters and Downspouts		X		
Roof Drains/Scuppers		X		Modular Contractor to coordinate with Site Contractor for placement
Roofing – Standing Seam Metal Roof		X		Match existing TKK
Modular Building Damp Proofing and Waterproofing		X		
Division 08 – Openings:				
Doors		X		
Door Hardware		X		
Windows		X		
Division 09 – Finishes:				
Acoustic Ceilings		X		
Gypsum Board Ceilings				N/A
Lath and Plaster		X		Integral Color, Match existing TKK
FRP Wall Finish		X		Coordinate with FCUSD
Metal Soffit		X		
Tackboard		X		Coordinate with FCUSD
Floor Finish		X		
Wall Base		X		
Painting and Coatings		X		Match existing TKK

Description	Site Contractor	Modular Contractor	Others	Comments
Division 10 – Specialties:				
Toilet Accessories		X		Mirrors & Grab bars, Dispensers OFOI
Building Fire Extinguishers		X		
Building ID and ADA Signage	Building Room and Building ID signage	Restroom signage		Coordinate Room numbering w/ FCUSD
Site Signage	X			
Division 11 – Equipment:				
Smart TV's		X	X	Blocking, Power & Data Infrastructure by Modular Contractor
Whiteboards		X		
Division 12 – Furnishings:				
Casework and Countertops		X		
Window Coverings			X	
Furniture			X	
Division 13 – Special Construction:				
Modular Buildings:				
Design and Engineering, Structural, and MEP		X		Foundation Shop-Drawings to be reviewed by Modular Company Structural Engineer
Manufacture Buildings		X		
Deliver, Set, and Weld Embeds		X		
All Finishes		X		

Description	Site Contractor	Modular Contractor	Others	Comments
Division 23 – Heating, Ventilating, and Air Conditioning (HVAC):				
Design		X		
HVAC Equipment		X		Rooftop Units
All Building Plumbing and Trim		X		
Condensate Drain		X		Condensate will drain into gutter
Drinking Fountains at Modular Buildings		X		ADA rails by others
Energy Management System/BMS		X	X	Pathways by Modular, Controls OFOI
Division 26 – Electrical:				
Design – Power and Lighting including Photovoltaic Panels		X		Photovoltaics - N/A per Modular Contractor
MDP in Building	X	X		Blocking of MDP by Modular Contractor
Subpanels in Building		X		
Lighting		X		
Grounding, Install and Test	X			
Site Power and Lighting	X			
Integration and Networking to BMS		X	X	Pathway by Modular, Controls OFOI

Description	Site Contractor	Modular Contractor	Others	Comments
Division 27 – Communications: Other than pathways, all data required systems will be provided by the owner AV cabling and equipment will be provided by the owner othrn than the power and assistive listening				
Telephone/Telecom Systems:				
Design			X	
Empty Conduit and Back Boxes in Building		X		
Conduit to Building	X			
Telephone System and Testing			X	
Data:				
Design			X	
Empty Conduit and Back Boxes in Building		X		
Conduit to Building	X			
Data Equipment and Cabling			X	
IDF Cabinet			X	Blocking by modular contractor
Power for IDF		X		Dedicated Circuit by modular contractor
Signal Cabinet			X	Blocking by modular contractor
Clock/Bell/Intercom:				
Design			X	
Empty Conduit and Back Boxes in Building		X		
Conduit to Building	X			
Equipment and Cabling			X	
AV Systems:				
Design			X	
Classroom Monitor and Mounts			X	Blocking by modular OFOI
Classroom AV System			X	
Power for Classroom Monitors		X		
Assistive Listening System	X			
Division 28 – Electronic Safety and Security:				
Fire Alarm:				
Design			X	
Empty Conduit and Back Boxes in Building		X		
Conduit to Building	X			
All Fire Alarm Control and Annunciator Panels	X			
Power for FACP/FAEP (in modular buildings)		X		
FACP/FAEP	X			

Description	Site Contractor	Modular Contractor	Others	Comments
Security System:				
Design			X	
Empty Conduit and Back Boxes in Building		X		
Conduit to Building	X			
Cameras and Equipment			X	OFOI
Division 31 – Earthwork:				
Site Clearing:				
Grubbing	X			
Earthwork – Rough Grading	X			
Grading:	X			
Excavation and fill: General	X			
Excavation and fill: Modular	X			Backfill by Site Contractor
Finish Grading and Re-Grading After the Form Work is Removed by the Modular Contractor	X			Modular Contractor to coordinate ALL utilities hook- up with Site Contractor (stubs out 6")
Erosion and Sediment Control	X			
Soil Treatment	X			
Division 32 – Exterior Improvements				
Asphalt/Concrete:				
Driveways/Parking	X			
Walkways	X			
Curbs, Gutters and Sidewalks	X			
Pavement Markings	X			
Gates and Fencing	X			
Irrigation	X			
Planting	X			
Turf and Grasses	X			

Description	Site Contractor	Modular Contractor	Others	Comments
Division 33 – Utilities				
Storm Drains:				
Site	X			
Domestic Water:				
Water Service to Meter Inc. Trenching	X			
Water Service to Meter	X			Coordinate with Modular Contractor
Water Service (from within 6" of buildings)	X			
SOV at Buildings	X			
Connect to Buildings	X			
Chlorination – Site Lines	X			
Chlorination – Building Lines	X			
Sanitary Sewer:				
Site to POC (from within 6" of building)	X			
Cleanouts at POC	X			
Connections at Building	X			

END OF SECTION 13 34 23.01

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Above ground piping.
B. Escutcheons.
C. Expansions - hose and braid.
D. Mechanical couplings.
E. Pipe hangers and supports.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
B. Section 21 05 23 - General-Duty Valves for Water-Based Fire-Suppression Piping.
C. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.
D. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.
E. Division 22 - Plumbing
F. Division 23 - HVAC
G. Division 26 - Electrical
H. Division 28 - Electronic Safety and Security

1.3 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.
E. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2024.
F. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
G. ASME B16.25 - Buttwelding Ends; 2022.
H. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.
I. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
K. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

M. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2024.
N. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.
O. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
P. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.
Q. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.
R. AWWA C606 - Grooved and Shouldered Joints; 2022.
S. NFPA 13 - Standard for the Installation of Sprinkler Systems: 2022
T. NFPA 24 - Standard for the Installation of Private Fire Service Mains and their Appurtenances; 2022
U. NFPA 25 - Standard for the Testing, Inspection, and Maintenance of Water Based Fire Suppression Systems; 13CA
V. NFPA 72 - National Fire Alarm and Signaling Code; 2022
W. UL (DIR) - Online Certifications Directory; Current Edition.
X. California Building Code; 2022
Y. California Fire Code; 2022

1.4 SUBMITTALS

A. Contractor to include items listed in product section along with any additional items required to provide a complete and fully functioning installation per NFPA 13 and all adopted building and fire codes.
B. Product Data: Provide manufacturer's catalog information. Where more than one product or model is available, provide red marking arrows or highlights on the cut sheets to clearly identify the product models, finishes, orientations, and any further clarification needed of the intended products for use, to complete a thorough review.
C. Contractor Shop Drawings: Used for coordination and as installation drawings to indicate materials and finishes used, joint methods, pipe supports, elevations, floor and wall penetration details, and sealing methods. Indicate installation layout, hanger layout, weights, mounting and support details, seismic restraints with calculations, and piping connections.
D. Engineers review of submittals does not relieve Contractor from coordinating installation of work with other trades, or from compliance with Codes and Standards.
    1. Copies of engineers drawings cannot be used as the contractors installation drawings for review. Engineers drawings are used for submittal and approval to DSA only and do not show the contractors continued coordination with other trades, fabricated lengths of pipe, or appropriate take-outs for fittings.
E. Project Record Documents: Record actual locations of components and tag numbering for final as builts in clients O&M's.
F. Operation and Maintenance Data: Include As-Built drawings, equipment and material data sheets, installation instructions, and spare parts lists.
G. Provide Owner with the following:
    1. Manufacturer's literature and instructions describing operation and maintenance of equipment and devices installed.

2. Typewritten chart with identification and location of all access panels serving equipment and valves. Incorporate into Operation & Maintenance (O&M) manual.
3. Typewritten valve schedule indicating valve number, fixture/equipment or areas served by each numbered valve. Incorporate into O&M manual.
4. 8-1/2 x 11 laminated flow diagram showing isolation valve locations, drain valve locations, and system boundaries, where applicable, and attach it to the system riser.
5. Current copy of NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
6. Contractors As-builts of final installation.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B. Fabrication shop must provide welding certifications and copy of weld stamp when requested. Weld stamp to be provided on all pipe at welds.
C. Contractor Qualifications: Provide licensed persons employed by sprinkler contractor to perform planning, calculations, layout, installation, and testing of fire protection systems. The following are acceptable:
   1. Licensed Professional Engineer
   2. National Institute for Certification of Engineering Technologies (NICET) Level III
   3. Certified sprinkler designer
D. Installer Qualifications: Company specializing in performing the work of this section shall provide journeyman sprinkler fitter(s) for installation and supervision with minimum 5 years experience.
E. Contractor shall be licensed in the State of California for installation of fire protection systems.
F. Comply with UL (DIR) requirements.
G. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
H. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
I. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under provisions of Division 01
B. Store and protect products under provisions of Division 01
C. All materials shall be stored in a clean, dry space.
D. Promptly inspect shipments to ensure material is undamaged and complies with Specifications. Storage and protection methods must allow inspection to verify products.
E. Deliver and store valves in shipping containers, with labeling in place.
F. Provide temporary protective coating on cast iron and steel valves.

G. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
H. Furnish pipe with plastic end-caps/plugs on each end of pipe. Maintain end-caps/plugs through shipping, storage and handling, and installation to prevent pipe-end damage and to eliminate dirt and construction debris from accumulating inside of pipe. Protect fittings and unions by storage inside or by durable, waterproof, aboveground packaging.
I. Cover pipe and fitting to prevent rust, corrosion, or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade.
J. Offsite storage agreements will not relieve Contractor from using proper storage techniques.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Sprinkler Systems: Conform work to NFPA 13.
   1. Follow DSA requirements
B. Comply with all building and fire code adoptions for the project location.
C. Welding Materials and Procedures: Comply with ASME BPVC-IX.
D. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.2 BURIED PIPING:

2.3 PIPING TO 5'-0" OUTSIDE BUILDING FACE

A. Ames ES.A - Series IBR - In Building Riser
B. Steel Pipe: ASTM A 53/A 53M Schedule 40 or ASTM A 795 Standard Weight, galvanized, with AWWA C105 polyethylene jacket, or double layer, half-lapped polyethylene tape.
C. Ductile Iron Pipe: AWWA C151/A21.51. Ductile iron, Class 52, American Water Works Association (AWWA) C151, minimum 350 psi working pressure, with standard cement mortar lining, AWWA C104, American National Standards Institute (ANSI) A21.4
   1. Fittings: AWWA C110/A21.10, Ductile iron or grey iron, mechanical joint, 350 psi working pressure, AWWA C153, cement mortar lined, AWWA C104.
   2. Encasement: Polyethylene encasement, 0.2 mm(8 mil) thick, AWWA C105
   3. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket.
   4. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.4 ABOVE GROUND PIPING

A. Carbon Steel Pipe 2" and smaller: ASTM A53 Schedule 40 or ASTM A795 Schedule 40, black or galvanized.
   1. Fittings: ASME B16.9 wrought steel, buttwelded, ASTM A234/A234M wrought carbon steel or alloy steel, or ASME B16.5 steel flanges and fittings.
      a. Cast Iron Flanged Fittings: ASME B16.1, flanges and flanged fittings.

b. Cast Iron Threaded Fittings: Class 125, ANSI B16.4, 175 psi CWP rating.
c. Malleable Iron Threaded Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M class 150, 300 psi CWP rating, ASME B16.3
d. Ductile Iron Threaded Fittings: ASME B16.3, ASTM A536 Grade 65-45-12, thread per ASME B1.20.1; shall be UL listed for fire protection use.
    1) Ductile iron threaded fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage and/or facilitate aggressive internal pipe corrosion. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns, per manufacturer. Any deficiencies or damage caused to owners system or property due to over-tightening, shall be the full liability and responsibility of the contractor to pay for and correct.
e. Carbon steel butt weld, ASTM A234 Grade WPB/American Society of Mechanical Engineers (ASME) B16.9, standard weight, seamless.
f. Ductile iron or malleable iron, roll grooved for mechanical coupling: ASTM A47, 175 psi CWP rating, malleable iron.
    1) Fitting, gasket, and coupling shall be furnished by same manufacturer.
g. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
h. Mechanical formed fittings: ASME 16.9, including, but not limited to, tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.

2. Joints:
    a. Threaded, tapered pipe threads, ANSI B1.20.1
    b. Flanged, cast iron, 175 psi CWP rating, ANSI B16.1, square head machine bolts with semi-finished hexagon nuts, ASTM A183, neoprene gasket
    c. Welded, welding electrodes shall be Lincoln or equal with coating and diameter as recommended by manufacturer for type and thickness of work being done.
    d. Mechanical:
        1) Flexible mechanical, malleable iron, ASTM A47, equal to Victaulic Style 75
        2) Rigid mechanical, ductile iron, ASTM A-536, equal to Victaulic Style 009N or 009V
        3) Wet systems gasket: Grade E EPDM gasket per UL 157 and UL 213
        4) Rigid or zero flex type couplings shall be provided when operating pressures cause piping to move out of place or sway on hangers. Flexible couplings may be used where pipe is braced or clamped into rigid position.

B. Carbon Steel Pipe 2-1/2" and larger: Schedule 10 pipe ASTM A795, ASTM A135, black or galvanized.
    1. Fittings:
        a. Carbon steel butt weld, ASTM A234 Grade WPB/ASME B16.9, Schedule 10, seamless

b. Ductile iron or malleable iron, roll grooved for mechanical coupling, 175 psi CWP rating, malleable iron conforming to ASTM A47.
   1) Fitting, gasket, and coupling shall be furnished by same manufacturer.
2. Joints:
   a. Welded, welding electrodes shall be Lincoln or equal with coating and diameter as recommended by manufacturer for type and thickness of work being done.
   b. Mechanical:
      1) Flexible mechanical, malleable iron, ASTM A47, equal to Victaulic Style 75
      2) Rigid mechanical, ductile iron, ASTM A-536, equal to Victaulic Style 009N or 009V
      3) Wet systems gasket: Grade E EPDM gasket per UL 157 and UL 213
      4) Rigid or zero flex type couplings shall be provided when operating pressures cause piping to move out of place or sway on hangers. Flexible couplings may be used where pipe is braced or clamped into rigid position.

C. Flexhead Flexible Hose Assemblies and End fittings:
   1. Composition: 100% Type 304 Stainless Steel
   2. Shall be fully welded non-mechanical fittings, braided, leak-tested with minimum 25 mm(1") true-bore internal corrugated hose diameter
   3. FlexHead Ceiling Bracket:
      a. Composition: Type G90 Galvanized Steel
      b. Type: Direct attachment type, having integrated snap-on clip ends positively attached to the ceiling using tamper-resistant screws
      c. Flexible hose attachment: Removable hub type with set screw
D. Plain end couplings (Roust-A-Bouts, Plainloks or similar couplings) are not allowed on either new or existing sprinkler systems.
E. Adjustable drop nipples are not allowed on either new or existing sprinkler systems.
F. All fittings for galvanized pipe shall match the pipe finish and be galvanized.
G. Clamp-on or saddle type fittings (i.e. mechanical tees or tee lox) are not allowed on new pipe. Outlet fittings inserted into holes drilled into piping are not allowed.

2.5 ESCUTCHEONS

A. Material:
   1. Fabricate from nonferrous metal.
   2. Chrome-plated.
B. Construction:
   1. Mounting on pipe use split-pattern or split ring type.

2.6 PIPE HANGERS AND SUPPORTS

A. Provide hangers and associated parts to support piping in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet requirements of NFPA 13 and manufacturer's installation instructions.
   1. All hanger materials shall be listed for fire protection use.

B. Select and size building attachments per Manufacturer Standardization Society (MSS) standards and manufacturer's published load rating.
C. Coordinate hanger support installation to group piping of all trades.
D. Hang pipe from building members using either concrete inserts for concrete construction or beam clamps for steel construction. Installation shall comply with manufacturer's installation instructions. Expansion type inserts may be used for branch piping.
E. Suspend hangers by means of electroplated zinc or hot-dipped galvanized finish hanger rods, attachments, and supports.
F. Support pipe from top flange of beams.
G. Do not support equipment or piping from metal roof deck that does not have a concrete poured top.
H. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
    1. Manufacturers:
        a. Eaton; www.eaton.com; Tolco Fire Protection Solutions.
        b. Anvil International; www.anvilintl.com/#sle.
I. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, swivel ring.
    1. Manufacturers:
        a. Anvil International; www.anvilintl.com/#sle.
        b. Eaton; www.eaton.com; Tolco Fire Protection Solutions
J. Vertical Support: Steel riser clamp.
    1. Manufacturers:
        a. Anvil International: www.anvilintl.com/#sle.
        b. Eaton; www.eaton.com; Tolco Fire Protection Solutions.
K. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support. Pipe stands shall be provided with a galvanized finish and be anchored into the floor.
    1. Manufacturers:
        a. Anvil International: www.anvilintl.com/#sle.
        b. Eaton; www.eaton.com; Tolco Fire Protection Solutions.
L. Seismic Hangers:
    1. Restraining clips/clamps are required in locations where vibration may be a concern.
    2. Install flexible fitting at building's expansion or seismic joints per manufacturer's instructions.
    3. All seismic hangers shall be listed for fire protection use.
    4. Manufacturers:
        a. Anvil International Seismic Bracing Products.
        b. Eaton: Tolco Fire Protection Solutions.

2.7 EXPANSION JOINTS AND LOOPS - HOSE AND BRAID

A. Manufacturers:
    1. The Metraflex Company; FireLoop: www.metrafire.com/#sle.
B. Provide flexible loops with two flexible sections of hose and braid, two 90-degree elbows, and 180-degree return with support bracket and air release or drain plug.

C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
D. Flexible Connectors: Grooved, braided type with wetted components of stainless steel, sized to match piping.
   1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
   2. Provide necessary accessories including, but not limited to, swivel joints.

2.8 MECHANICAL COUPLINGS

A. Manufacturers:
   1. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
   2. Victaulic Company: www.victaulic.com/#sle.
B. Rigid Mechanical Couplings for Grooved Joints:
   1. Dimensions and Testing: Comply with AWWA C606.
   2. Minimum Working Pressure: 300 psig.
   3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
   4. Housing Coating: Factory applied orange enamel or galvanized finished.
   5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.
   7. Couplings provided shall be from the same manufacturer of the fitting manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.
B. Remove scale and foreign material, from inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install hydraulically designed sprinkler system and associated accessories according to NFPA 13 and as shown on the contract drawings.
B. Install pipe, fittings, couplings, and valves according to requirements of manufacturer.
C. Pipe and fittings shall be of corresponding materials when assembled.
D. Where galvanized pipe is used, hangers, seismic braces, and fittings shall match the pipe type and also be galvanized or zinc coated.
E. Group piping whenever practical at common elevations, taking into account space needed by other trades.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Provide auxiliary drains at low points of systems per requirements of NFPA 13.
I. Do not penetrate building structural members unless indicated.
J. Provide sleeves when penetrating footings, floors, and walls. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Non bearing wall partitions shall not require sleeves or to be provided with clearances.
   2. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
      a. Fill hole clearance with pea gravel or insulation and caulk.
K. Escutcheons:
   1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
   2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
   3. Use split chrome plated escutcheons in occupied spaces to conceal openings for wall and ceiling penetrations.
L. Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
M. Use joint compound sparingly.
N. Provide reducing fittings or provide shop fabricated weld-o-lets to change pipe sizes in sprinkler/standpipe systems.
   1. No bushings or grooved reducing couplings, such as Victaulic Style 750, are allowed.
O. Coat exposed threads when exposed to outside elements or where located in an attic space, with rust inhibiting paint equal to Rust-Oleum.
   1. Pipe dope and tape are not approved equivalents.
   2. Provide black paint with black pipe and silver paint with galvanized pipe.
   3. Wipe threads clean with a cloth and use spray can application to coat threads only.
      a. Overspray on pipe and/or fitting is not of concern.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.
B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 21 05 23

GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bronze butterfly valves with indicators.
B. Iron butterfly valves with indicators.
C. Check valves.
D. Bronze OS&Y gate valves.
E. Iron OS&Y gate valves.
F. NRS gate valves.
G. Indicator posts.
H. Trim and drain valves.

1.2 RELATED REQUIREMENTS

A. Section 21 05 00 - Common Work Results for Fire Suppression
B. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.
C. Section 21 13 00 - Fire-Suppression Sprinkler Systems.
D. Division 22 - Plumbing
E. Division 23 - HVAC
F. Division 26 - Electrical
G. Division 28 - Electronic Safety and Security

1.3 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300; 2021.
D. FM (AG) - FM Approval Guide; Current Edition.
E. FM 1120/1130 - Approval Standard for Fire Service Water Control Valves (OS&Y and NRS Gate Valves); 1997.
F. FM 1140 - Approval Standard for Quick Opening Valves 1/4 Inch through 2 Inch Nominal Size; 1998.
G. NFPA 24 - Standard for the Installation of Private Fire Service Mains and their Appurtenances; 2019
H. NFPA 72 - National Fire Alarm and Signaling Code; 2022
I. UL (DIR) - Online Certifications Directory; Current Edition.
J. UL 258 - Shutoff Valves for Trim and Drain Purposes for Fire Protection Service; Current Edition, Including All Revisions.
K. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.

L. UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.
M. UL 789 - Indicator Posts for Fire-Protection Service; Current Edition, Including All Revisions.
N. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.
O. California Building Code; 2022
P. California Fire Code; 2022

1.4 SUBMITTALS

A. Contractor to include items listed in product section along with any additional items required to provide a complete and fully functioning installation per NFPA 13 and all adopted building and fire codes.
B. Product Data: Provide manufacturer's catalog information. Where more than one product or model is available, provide red marking arrows or highlights on the cut sheets to clearly identify the product models, finishes, orientations, and any further clarification needed of the intended products for use, to complete a thorough review.
C. Review of submittals does not relieve Contractor from coordinating installation of work with other trades, or from compliance with Codes and Standards.
D. Project Record Documents: Record actual locations of components and tag numbering.
E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
F. Provide Owner with the following:
    1. Manufacturer's literature and instructions describing operation and maintenance of equipment and devices installed.
    2. Typewritten chart with identification and location of all access panels serving equipment and valves. Incorporate into Operation & Maintenance (O&M) manual.
    3. Typewritten valve schedule indicating valve number, fixture/equipment or areas served by each numbered valve. Incorporate into O&M manual.
    4. 8-1/2 x 11 laminated flow diagram showing isolation valve locations, drain valve locations, and system boundaries, where applicable, and attach it to the system riser.
    5. Current copy of NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

1.5 QUALITY ASSURANCE

A. Comply with UL (DIR) requirements.
B. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
C. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
D. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under provisions of Division 01
B. Store and protect products under provisions of Division 01
C. All materials shall be stored in a clean, dry space.
D. Promptly inspect shipments to ensure material is undamaged and complies with Specifications. Storage and protection methods must allow inspection to verify products.
E. Prepare valves for shipping as follows:
    1. Protect internal parts against rust and corrosion.
    2. Protect threads, grooves, and flanged faces.
    3. Set valves open to minimize exposure of functional surfaces.
F. Deliver and store valves in shipping containers, with labeling in place.
G. Use the following precautions during storage:
    1. Maintain valve end protection and protect flanges and specialties from dirt.
        a. Provide temporary inlet and outlet caps.
        b. Maintain caps in place until installation.
    2. Store valves in shipping containers and maintain in place until installation.
        a. Store valves indoors and maintain at higher than ambient dew point temperature.
        b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.
H. Use the following precautions for handling:
    1. Use sling to handle large valves, rig to avoid damage to exposed parts.
    2. Do not use operating handles or stems as lifting or rigging points.
I. Offsite storage agreements will not relieve Contractor from using proper storage techniques.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Coordinate with Material Schedule used on fire sprinkler cover sheet.
B. Valve Pressure Ratings: Not less than 175 psi pressure rated, or higher as required.
C. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.2 **BRONZE BALL VALVES WITH INDICATORS**

A. Manufacturers:
    1. Nibco; www.nibco.com.
    2. Victaulic; www.victaulic.com.
    3. Watts; www.watts.com
B. Minimum Pressure Rating: 175 psig.
C. Body Material: Bronze.
D. Seat: Chrome plated brass.
E. Stem: Bronze or stainless steel.
F. Actuator: Brass travel nut.
G. Supervisory Switch: Internal or external.

2.3 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers:
   1. Nibco: www.nibco.com.
   2. Kennedy; www.kennedy.com
   3. Victaulic; www.victaulic.com
B. UL 1091 and FM 1112 listed.
C. Minimum Pressure Rating: 175 psig.
D. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
E. Seat: EPDM.
F. Stem: Stainless steel.
G. Disc: Ductile iron with EPDM coating.
H. Actuator: Worm gear or traveling nut.
I. Body Design: Grooved-end or wafer style.

2.4 SWING CHECK VALVES

A. Manufacturers:
   1. Kennedy; www.kennedyvalve.com.
   2. Nibco; www.nibco.com
   3. Victaulic; www.victaulic.com
B. UL 312 and FM 1210 listed.
C. Minimum Pressure Rating: 175 psig.
D. Body Material: Cast or ductile iron.
E. Clapper: Bronze, EPDM-coated ductile iron, or stainless steel.
F. Seat: Bronze or EPDM-coated bronze.
G. End Connections: Flanged.

2.5 BRONZE OS&Y GATE VALVES

A. Manufacturers:
   1. Nibco; www.nibco.com.
   2. Kennedy; www.kennedy.com.
   3. Victaulic; www.victaulic.com
B. UL 262 and FM 1120/1130 listed.
C. Minimum Pressure Rating: 175 psig.
D. Body and Bonnet Material: Bronze or brass.
E. Wedge: One-piece bronze or brass.
F. Wedge Seat: Bronze.
G. Stem: Bronze or brass.
H. Packing: Non-asbestos PTFE.
I. End Connections: Threaded, grooved, or flanged.

2.6 IRON OS&Y GATE VALVES

A. Manufacturers:
   1. Kennedy Valve: www.kennedyvalve.com/#sle.

2. Nibco; www.nibco.com.
3. Victaulic; www.victaulic.com

B. UL 262 and FM 1120/1130 listed.
C. Minimum Pressure Rating: 175 psig.
D. Body and Bonnet Material: Cast or ductile iron.
E. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
F. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
G. Stem: Brass, bronze, or stainless steel.
H. Packing: Non-asbestos PTFE.
I. Supervisory Switch: External.

2.7 IRON NRS GATE VALVES

A. Manufacturers:
1. Kennedy Valve; www.kennedy.com
2. Nibco; www.nibco.com.
3. Victaulic; www.victaulic.com

B. UL 262 and FM 1120/1130 listed.
C. Minimum Pressure Rating: 175 psig.
D. Body and Bonnet Material: Cast or ductile iron.
E. Wedge: Cast or ductile iron with elastomeric coating.
F. Stem: Brass or bronze.
G. Packing: Non-asbestos PTFE.
H. Operation:
1. Operating nut for post-indicating valves.
2. Handwheel for non-post-indicating valves.

I. Post Plate: Provide for post-indicating valves.
J. End Connections: Flanged.

2.8 TRIM AND DRAIN VALVES

A. Ball Valves:
1. Manufacturers:
a. Nibco; www.nibco.com.
b. Victaulic; www.victaulic.com.
2. Description:
a. UL 258 or FM 1140 listed.
b. Pressure Rating: 175 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass or bronze.
e. Port Size: Full or standard.
f. Seat: PTFE.
g. Stem: Bronze or stainless steel.
h. Ball: Chrome-plated brass.
i. Actuator: Hand-lever.
j. End Connections: Threaded or grooved.

B. Angle Valves:
   1. Manufacturers:
      a. United Brass Works, Inc.; www.ubw.com.
      b. Nibco; www.nibco.com.
      c. Milwaukee; www.milwaukeevalve.com.
   2. Description:
      a. UL 258 or FM 1140 listed.
      b. Pressure Rating: 175 psig.
      c. Body Material: Brass or bronze.
      d. Ends: Threaded.
      e. Stem: Bronze.
      f. Disc: Bronze.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron, bronze, or aluminum.
C. Globe Valves:
   1. Manufacturers:
      a. United Brass Works, Inc.; www.ubw.com.
      b. Nibco; www.nibco.com.
      c. Milwaukee; www.milwaukeevalve.com.
   2. Description:
      a. UL 258 or FM 1140 listed.
      b. Pressure Rating: 175 psig.
      c. Body Material: Bronze with integral seat and screw-in bonnet.
      d. Ends: Threaded.
      e. Stem: Bronze.
      f. Disc Holder and Nut: Bronze.
      g. Disc Seat: Nitrile.
      h. Packing: Asbestos free.
      i. Handwheel: Malleable iron, bronze, or aluminum.
D. Test and Drain Valves:
   1. Manufacturers:
      a. AGF; www.testandrain.com
      b. Globe; www.globesprinkler.com
      c. Victaulic; www.victaulic.com
   2. Description:
      a. Pressure Rated: 300 psig
      b. Body Material: Brass or bronze
      c. Ends: Threaded
      d. Attachments: With pressure relief valve set to operate at 175 psi or 10 psi above system working pressure, whichever is greater.
      e. Orifice: smallest size of sprinkler K-factor
E. Air Release Valves:
   1. Manufacturers:
      a. Engineered Corrosion Solutions

b. Potter Electric
c. AGF Manufacturing

2. Description:
   a. Automatic float type air vent
   b. UL listed, FM approved "Automatic Air release Valve for Sprinkler Systems"
   c. Rated to 175 psi water working pressure
3. Valve shall be installed in an accessible location to permit operation, maintenance, and visual inspection of the status of the valve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.
B. Remove packing materials.
C. Examine guides and seats by operating valves from the fully open position to the fully closed position.
D. Examine valve threads and mating pipe for form and cleanliness.
E. Examine mating flange faces for conditions that might cause leakage.
   1. Check bolting for proper size, length, and material.
   2. Verify gasket for size, defects, damage, and suitable material composition for service.
   3. Replace defective valves with new valves.

3.2 INSTALLATION

A. Install valves in accessible locations to allow for operation, inspections, tests, and maintenance.
B. Install listed valves in accordance with their listing.
C. Install valves in accordance with manufacturer's instructions.
D. Support valves independently of adjacent piping.
E. Install valves in horizontal piping with stem at or above pipe center.
F. Position valves to allow full actuator movement.
G. Install OS&Y valves with full clearance for rising stem. Install surrounding components so they do not interfere with nor are they impacted by full extension of rising stem.
H. Install permanent identification signs indicating portion of system controlled by each shutoff valve.
I. Install threaded-end valves with unions upstream and downstream.
J. Install valve tags. See Section 21 05 53. Label valves in accordance with NFPA standard applying to the piping system in which valves are installed.

END OF SECTION

SECTION 21 05 53

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Stencils.
D. Pipe markers.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
B. Section 09 91 23 - Interior Painting: Stencil paint.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.4 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
B. Product Data: Provide manufacturers catalog literature for each product required.
C. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.
D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Control Panels: Nameplates.
B. Piping: Pipe markers.
C. Valves: Nameplates.

2.2 MANUFACTURERS

A. Brady Corporation: www.bradyid.com.
B. Champion America, Inc: www.Champion-America.com.
C. Seton Identification Products: www.seton.com/aec.

2.3 NAMEPLATES

A. Manufacturers:
1. Brimar Industries, Inc: www.pipemarker.com/#sle.

2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Description: Laminated three-layer plastic with engraved letters.
1. Letter Color: White.
2. Letter Height: Equipment, control panels 1 inch.
3. Letter Height: Controls and small components, 1/4 inch.
4. Background Color: Red.

2.4 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
2. Brady Corporation: www.bradycorp.com/#sle.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
5. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
6. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.5 STENCILS

A. Manufacturers:
1. Brady Corporation; www.bradycorp.com/#sle.
2. Craftmark Pipe Markers; www.craftmarkid.com/#sle.
3. Insite Solutions, LLC; www.stop-painting.com/#sle.
4. Kolbi Pipe Marker Co; www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Direct Company; www.seton.com/#sle.

B. Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.

2.6 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
E. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with corrosion resistant chain.
C. Install plastic pipe markers in accordance with manufacturer's instructions.
D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
F. Identify valves in main and branch piping with tags.
G. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 21 13 00

FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.
B. System design, installation, and certification.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
B. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe and fittings.
C. Section 21 05 23 - General-Duty Valves for Water-Based Fire-Suppression Piping.
D. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.
E. Division 22 - Plumbing
F. Division 23 - HVAC
G. Division 26 - Electrical
H. Division 28 - Electronic Safety and Security

1.3 REFERENCE STANDARDS

A. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2022
B. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. Contractor to include items listed in product section along with any additional items required to provide a complete and fully functioning installation per NFPA 13 and all adopted building and fire codes.
B. Product Data: Provide manufacturer's catalog information. Where more than one product or model is available, provide red marking arrows or highlights on the cut sheets to clearly identify the product models, finishes, orientations, and any further clarification needed of the intended products for use, to complete a thorough review. Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections, and accessories.
C. Shop Drawings: Fire sprinkler system design is not a deferred submittal.
    1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
    2. Indicate hydraulic calculation placards, detailed pipe layout, hangers and supports, sprinklers, seismic details and calculations, components and accessories. Indicate system controls.
    3. Submit shop drawings to LP Engineers for approval.
        a. Engineer’s drawings are not contractors coordinated shop or installation drawings and cannot be used for contractors submittal.

4. Installation is to conform to approved fire sprinkler plans.
5. Approved documents do not relieve the contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other trades.
6. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.

D. Material Data: Approved material data is a guideline. The fire sprinkler system design parameters must be strictly adhered to. Alternate manufacturers may be submitted to LP Consulting Engineers, Inc. for review of project compliance. A copy of the approved material data must be on the project site for the Project Inspector prior to the commencement of installation.
E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
F. Operation and Maintenance Data: Include components of system, servicing requirements, record as-built drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
   2. Sprinkler Wrenches: For each sprinkler type.
H. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
I. Provide Owner with the following;
   1. Manufacturer's literature and instructions describing operation and maintenance of equipment and devices installed.
   2. Typewritten chart with identification and location of all access panels serving equipment and valves. Incorporate into Operation & Maintenance (O&M) manual.
   3. Typewritten valve schedule indicating valve number, fixture/equipment or areas served by each numbered valve. Incorporate into O&M manual.
   4. 8-1/2 x 11 laminated flow diagram showing isolation valve locations, drain valve locations, and system boundaries, where applicable, and attach it to the system riser.
   5. Final contractor corrected As-Builts of completed installation.
   6. Current copy of NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.
B. Conform to UL and/or FM requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
D. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.

E. Contractor Qualifications: Provide licensed persons employed by sprinkler contractor to perform planning, calculations, layout, installation, and testing of fire protection systems. The following are acceptable:
   1. Licensed Professional Engineer
   2. National Institute for Certification of Engineering Technologies (NICET) Level III
   3. Certified sprinkler designer
F. Installer Qualifications: Company specializing in performing the work of this section. with minimum five years experience approved by manufacturer.
   1. Contractor shall be licensed in the State of California for installation of fire protection systems.
   2. Installing company must have a valid State of California contractors' license with a C-16 classification.
G. Equipment and Components: Provide products that bear UL and FM label or marking.
H. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.6 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

A. Coordinate with Material Schedule on contract document drawings.
B. Fire protection systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
C. Fire protection systems and equipment shall include, but are not limited to, all piping, valve assemblies, fire pumps, electrical and control panels, conduits and other components.
D. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the State of California.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.
B. Reference specification 21 0500 - Common Work Results for Fire Suppression section 1.06 for additional information.

PART 2 PRODUCTS - ALL PRODUCTS SHALL CONFORM TO CONTRACT

DOCUMENTS INCLUDING APPROVED MATERIAL DATA.

2.1 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted on drawings, including all areas, rooms, spaces above and below ceilings, entry ways, overhangs (if applicable), and all other areas requiring sprinkler protection in accordance with NFPA 13.
B. Occupancy: Office spaces, Corridors, Bathrooms, Classrooms, Dining Areas, and common spaces - Light Hazard.

C. Occupancy: Electrical and IT rooms, Janitor closets, Mechanical rooms, Linen closets, Kitchens, and Storage areas not exceeding shelving 8ft in height - Ordinary Hazard Group 1.
D. Occupancy: Chemistry and Lab Classrooms, Mercantile, Pharmacy, and Storage areas with storage not greater than 12ft in height - Ordinary Hazard Group 2.
E. Interface system(s) with building fire and smoke alarm system.
F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to fire sprinkler riser. Supply no less than two (2) spare sprinklers of each type and temperature rating used on project. Storage cabinet to include a wrench(s) applicable to sprinkler types.

2.2 SPRINKLERS

A. Finished Ceiling Type: Concealed pendant type with matching screw on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Brass.
   4. Cover Plate Finish: White.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
   6. Manufacturers:
      a. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
      b. Viking; vikinggroupinc.com.
   7. Application: All finished ceilings
   8. Installed with side takoffs or on return bends with hard pipe or when permitted, with flexible sprinkler drops
B. Exposed Area Type: Pendant or Upright.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Brass.
   4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
   5. Manufacturers:
      a. Tyco Fire Protection Products; www.tyco-fire.com
      b. Viking; vikinggroupinc.com.
   6. Application: Areas with exposed construction unless noted otherwise
C. Guards: chrome plated with style and listing to match the sprinkler head type used.
D. Flexible Drop System: Flexible Hose Assembly and End Fittings.
   1. Composition: 100% Type 304/316 Stainless Steel
   2. Shall be leak-tested with minimum 1” true-bore internal corrugated hose diameter
   3. Straight Hose Assembly
   4. Provide braided type tube not exceeding 4ft lengths with straight sprinkler head connection as required for the application.
      a. Elbow connections are not permitted without approval and hydraulic verification from engineer first.
   5. Types acceptable that do not exceed the equivalent length of 28.7ft with a maximum of 3 bends. Equivalent lengths less than or equal to that are acceptable for use.
   6. Manufacturers:

a. FlexHead Industries Model 20XXH; www.asc-es.com.
b. Victaulic Company Model AH2; Vic-Flex: www.victaulic.com/#sle.
c. SuperFlex Model 20XXSF; www.asc-es.com.

2.3 PIPING SPECIALTIES

A. Zone Control Valves
1. Outside screw and yoke or butterfly, U.L. listed.
2. Valves shall be sealed open using approved seal.
3. Provide weatherproof actuator housing with two single pole double throw switches.

2.4 HORN STROBE

A. Waterflow alarm horn/strobe shall be included at building riser. Waterflow alarm shall be compatible with building's fire alarm system, be rated for exterior use, and be located outside fire riser or above FDC, if one is provided on exterior wall.
1. Do not use round bells

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standards and adopted fire codes.
1. DSA requirements and DSA approved plans.
B. Approved documents do not relieve the fire sprinkler contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other trades.
C. Strict adherence to the contract design documents is required. Any deviation from the contract documents requiring additional plan review, hydraulic calculations, structural review or calculations, or seismic calculations, shall be submitted to LP Consulting Engineers, Inc. for review prior to making changes. LP Consulting Engineers, Inc. to provide calculations and updated plans for DSA approval.
D. Install equipment in accordance with manufacturer's instructions.
E. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
F. Systems that are hydraulically calculated include 1.2 factor for design area.
G. Hydraulically calculated system are designed to a minimum of 10% below the available water flow curve.
H. Fire Protection System Layout and Installation Drawings:
1. Contractor shall review Design Drawings and Specifications, and shall provide coordinated installation drawings and product data sheets.
2. Layout of fire protection system has been established for the level shown in contract documents, as it relates to structure, and mechanical/electrical systems in building, and must be adhered to. Other layouts shall be produced by Contractor in coordination with building components.
3. Conceal sprinkler piping above ceilings where possible.

4. Contractor shall consult with Architect during development of piping layout to avoid conflicts with general appearance. Pipe routing is a critical issue due to attributes of this building.
5. Contractor shall be responsible to have examined "Reflected Ceiling" drawings as well as Mechanical, Electrical, Piping, Information Technology, Structural and Architectural building plans prior to system layout.
6. Contractor shall coordinate routing of piping with other trades and Architect.
7. Contractor shall participate in coordination process and shall not install piping prior to coordination with other trades.

I. Locate outside alarm on building wall as indicated on Fire Sprinkler Shop Drawings.
J. Place pipe runs to minimize obstruction to other work.
K. Place piping in concealed spaces above finished ceilings.
L. Where pipe is exposed to outside elements, provide galvanized pipe, fittings, and hangers.
M. Threaded pipe where exposed threads are present outside, shall be coated with a corrosion resistant paint equal to Rust-Oleum.
   1. See specification 21 05 00 for reference.
N. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
O. All drops to sprinkler heads in finished ceilings shall be side or top takeoffs from the branch line pipe and shall be centered in ceiling tiles using hard pipe connections or when approved, with flexible sprinkler drops.
   1. No bottom takeoffs other than pendent sprinkler heads attaching directly to branchline pipes, shall be permitted.
P. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
Q. Flush entire piping system of foreign matter.
R. Install head guards on sprinklers where indicated on the drawing in addition to the following areas:
   1. All electrical and IT rooms without ceilings shall be provided with head guards.
   2. Sprinkler heads below obstructions in all mechanical spaces shall be provided with head guards.
S. Hydrostatically test entire system.
T. Required test to be witnessed by Fire Marshal.
U. Verification of weld inspection required prior to installation of fire sprinkler system.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 22 05 10

PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. References.
B. Description of Work.
C. Drawings and Specifications.
D. Industry Standards and Codes.
E. Site Examination.
F. Permits, Fees and Utility Connections.
G. Coordination of Work.
H. Progress of Work.
I. Submittals
J. Operation and Maintenance Manuals.
K. Project Record Documents.
L. Warranty.
M. Quality and Care
N. Access Doors.
O. Starting Equipment and Systems.

1.2 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
C. The requirements of this Section apply to all Work of Division 22.

1.3 REFERENCES

A. ANSI - American National Standards Institute.
B. ASTM - American Society for Testing Materials.
C. CEC - California Electric Code.
D. NEMA - National Electric Manufacturers' Association.
E. NFPA - National Fire Protection Association.
F. OSHA - Occupational Safety and Health Act.
G. UL - Underwriters' Laboratories.
H. See detailed References that are listed in individual sections.

1.4 DESCRIPTION OF WORK

A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing

operations necessary for the installation of the complete Plumbing System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.

B. The work shall also include the completion of details of plumbing work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

1.5 DRAWINGS AND SPECIFICATIONS

A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, and other plumbing work. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.

B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.

C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.

D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.6 INDUSTRY STANDARDS AND CODES

A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.

B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
   1. California Building Code, 2022.
   2. California Mechanical Code, 2022.
   3. California Plumbing Code, 2022.
   4. California Electrical Code, 2022.
   5. National Fire Protection Association.
   6. California Fire Code, 2022.
   7. California State Fire Marshal.
   8. Occupational Safety and Health Administration, including CAL-OSHA.
   9. California Energy Code, 2022.
   10. California Green Building Standards Code, 2022.
   11. State of California Code of Regulations, Title 24.
   12. Other applicable state laws.

C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes,

furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.

D. No material or product installed as a part of the Work shall contain asbestos in any form.

E. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.

1.7 SITE EXAMINATION

A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

1.8 PERMITS, FEES AND UTILITY SERVICES

A. Contractor shall pay for and obtain all permits and service required in the installation of this work.

B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

1.9 COORDINATION OF WORK

A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.

B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.

C. Arrange plumbing work in a neat, well-organized manner with the piping and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.

D. Verify the location of all equipment, plumbing devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

1.10 PROGRESS OF WORK

A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting

from defective or ill timed work performed under this section shall be borne by this Contractor.

1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

A. Plumbing systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
B. Plumbing systems and equipment shall include, but are not limited to, all piping, water heaters, expansion tanks, air compressors, vacuum pumps, electrical and control panels, conduits and other components.
C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

1.12 SUBMITTALS

A. See Division 1 for additional submittal procedures.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
C. Shop Drawing Submittals: Prepared specifically for this Project.
D. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.
E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
F. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.
G. Maintain a copy of the fire penetration installation instructions on site for use by the Inspector of Record.

1.13 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
B. LP Consulting Engineers, Inc. will consider requests for substitutions only within 7 days after date of Agreement.
C. Substitutions may be considered when a product becomes unavailable through no fault of the .
D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
F. A request for substitution constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner and LP Consulting Engineers, Inc. for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.

G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.

I. Substitution Submittal Procedure:
1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The LP Consulting Engineers, Inc. will notify in writing of decision to accept or reject request.
4. Present each substitution individually. If a proposed substitute in not found to be acceptable, then the specified item shall be supplied.

1.14 OPERATION AND MAINTENANCE MANUALS

A. See Division 1 for Closeout Submittals for Operation and Maintenance Manual requirements.

B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.

C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
1. Plumbing Systems.
2. Medical Gas Equipment, Piping and Alarm Systems.
3. Piping Systems.
4. Temperature Controls Systems.
5. Testing, Adjusting, and Balancing Reports.

D. Provide manufacturer's model number, design data, capacities, etc. for each piece of plumbing equipment furnished as a part of the Work.

E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.

F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.

G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.
H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

1.15 PROJECT RECORD DOCUMENTS

A. See Division 1 for Closeout Procedures.
B. Provide red-lined drawings accurately showing location of equipment and devices and size and routing of piping. Include notes explaining installed condition for complete understanding.

1.16 QUALITY ASSURANCE

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from LP Consulting Engineers, Inc. before proceeding.
D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have Work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

1.17 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.18 WARRANTY

A. See Division 1 for additional warranty requirements.
B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 QUALITY AND CARE

A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance

with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).

B. All capacities, sizes and efficiency ratings shown on the drawing are minimum. Gas meter and gas pressure reducing valve capacities are maximum allowable.

C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.

D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.

E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

F. Inspect and report concealed damage to carrier within their required time period.

G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.

H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

2.2 ACCESS DOORS

A. Coordinate access door requirements with Division 1. The more stringent requirements shall govern.

B. Provide access doors where access through floors, walls or ceilings is required to access plumbing equipment and plumbing devices or other systems requiring access for maintenance, test or observation.
   1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
   2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.

C. Established standard: Milcor of types listed below. Other acceptable manufacturers: Cesco, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
   1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
   2. Concealed hinges to allow 175 degree opening.
   3. Locks: flush, screw driver operated cam lock(s).
   4. Provide anchoring devices suitable for the construction into which the doors are framed.

D. Application (as applicable):
   1. In gypsum drywall walls and ceilings: Type DW.
   2. In ceramic tile walls: Type MS (stainless steel).
   3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

PART 3 EXECUTION

3.1 INSTALLATION

A. Access Doors
   1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
   2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
   3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
   4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
   5. Install in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with the requirements within this section.
B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

3.3 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS

A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic, duct and gas piping testing.
   1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
   2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
   3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.
B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
   1. Sanitary Sewer, Drain, Vent Piping: Pressure=10 Ft.Hd. / Medium= Water / Duration=4 Hours.
   2. Domestic Water Piping: Pressure=125 Psig / Medium= Water / Duration=4 Hours.
   3. Condensate drains: Pressure=10 Ft.Hd. / Medium=Water / Duration=4 Hours.
   4. Gas Piping: Pressure=60 Psig / Medium=Air and soap / Duration=8 Hours.

3.4 CUTTING AND PATCHING

A. Submit written request in advance of cutting or alteration which affects:
   1. Structural integrity of any element of Project.

2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.

B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.

C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

E. Restore work with new Products in accordance with requirements of Contract Documents.

F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements , to full thickness of the penetrated element.

H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.5 PRIMING AND PAINTING

A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted, including gas piping outdoors.
   1. Primer shall be as recommended by the paint manufacturer for each specific application.
   2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 09900 for other acceptable products.

B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except piping, or factory primed or finished.

C. Preparation:
   1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
   2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devoe KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
   3. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
   4. Galvanized Surfaces:

a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
b. Apply Devoe MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.

5. Uncoated Steel And Iron Surfaces:
   a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
   b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.
6. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devoe MIRROLAC metal primer or primer recommended by manufacturer.

D. Application:
   1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
   2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
   3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

3.6 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING

A. Start equipment and systems in accordance with manufacturer's written instructions..
B. Adjust for proper operation within manufacturer's published tolerances.
C. Demonstrate proper operation of equipment to Owner's designated representative.
D. Description:
   1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.
   2. Coordinate all testing and startup procedures with all other trades so that all non-plumbing and non-electrical work is completed and operational so that the specified testing can be performed.
E. Preliminary Work:
   1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
      a. Proper motor and fan/pump rotation.
      b. Flushing and cleaning of the system.
      c. Wiring
      d. Auxiliary connections
      e. Lubrication.
      f. Venting.
      g. Controls.
      h. Installation of filters and strainers.

i. Setting of relief and safety valves .

2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
3. The Contractor shall submit at least 30 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Plumbing equipment. This schedule shall include work on a system by system, floor by floor basis.
4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.
    a. The startup checklist will cover all related crafts, e.g., controls, electrical, plumbing, and a clean environment for equipment startup.
5. The Contractor shall schedule a tour with the Owner's representative and the Engineer to review startup conditions prior to equipment startup. This tour shall take place during the associated Engineer's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Engineer prior to attempting an equipment startup.
6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestartup check sheet.

F. Startup and Commissioning:
    1. System Startup and Operation:
        a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.
        b. The Contractor and the factory representative shall check all equipment during initial startup to insure correct rotation, proper lubrication, adequate fluids or air flows, nonoverloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for water flows throughout without blockages.Plumbing systems shall be checked for proper connections and positions, nonexcessive electrical characteristics and minimal vibration. Other miscellaneous equipment shall be started and operated as described above as applicable. Manufacturer's representative shall submit a preliminary written copy of equipment startup check sheet prior to leaving job site.
        c. After initial startup and operation of systems, the Contractor shall submit a report, showing proper operation before commencement of the final "Operation Test".
        d. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainers, cleanouts, packing replacement, and other consumables shall be provided

without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Engineer.

G. System Acceptance:
   1. General: The system installation shall be complete and tested for proper operation prior to acceptance testing "Operation Test" for the Owners authorized representative. A letter shall be submitted to the Engineer requesting system acceptance. This letter shall certify that all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing shall commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative and pass, the system will be accepted. The warranty period may begin at this time.

H. Operation Test:
   1. Provide all labor, equipment, and materials required to perform test.
   2. The test shall occur after all major equipment startup and balance services have been performed as specified. The purpose is to demonstrate that individual pieces of equipment and all related elements operate as one complete system and not to identify incomplete or defective work.
   3. All equipment is to be run in an automatic operating position and exercised for 72 hours to verify that they perform in accordance with the specified sequence of operation and designed operation logic.
   4. The Engineer's representative shall be notified and may be present for the initiation of the test.
   5. A log shall be prepared by the Contractor, to be submitted to the Engineer, of all tests including, but not limited to: time, temperatures, pressures, and other readings to prove all equipment is operating as specified.
   6. All temperatures, pressures, status indication, etc., shall be verified by at least one other means of measurement or visual verification of condition.
   7. Change set points and simulate conditions as directed to demonstrate:
      a. Ability to control to new set point.
      b. Interface between systems, fire alarm/fire sprinkler systems.
      c. Proper sequence and operation.
      d. Equipment safety systems and all automatic changeover/backup systems and alarms are functioning or will function.
   8. If unsatisfactory performance or a system failure is experienced for any reason, the test shall be repeated until 72 hour consecutive hours are achieved. The Engineer's representative shall make all final decisions of a satisfactory test.

END OF SECTION

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.
B. Expansion/seismic loops and compensators.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
C. The requirements of this Section apply to all Work of Division 22.

1.3 REFERENCE STANDARDS

A. EJMA (STDS) - EJMA Standards; Tenth Edition.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
   2. Expansion Loops/Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
C. Maintenance Data: Include adjustment instructions.
D. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.5 REGULATORY REQUIREMENTS

A. Conform to UL and FM requirements.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:
   1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
   2. The Metraflex Company: www.metraflex.com/#sle.
B. Inner Hose: Stainless steel.

C. Exterior Sleeve: Single braided, stainless steel.
D. Pressure Rating: 125 psi up to 12 inch.
E. Maximum Service Temperature: 450 degrees F.
F. Joint: Flanged or threaded with union.
G. Size: Use pipe sized units.
H. Maximum offset: 3/4 inch on each side of installed center line.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturers:
1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
2. The Metraflex Company: www.metraflex.com/#sle.
B. Inner Hose: Bronze.
C. Exterior Sleeve: Braided bronze.
D. Pressure Rating: 125 psi up to 2 inch.
E. Maximum Service Temperature: 450 degrees F.
F. Joint: Flanged or threaded with union.
G. Size: Use pipe sized units.
H. Maximum offset: 3/4 inch on each side of installed center line.
I. Application: Copper piping.

2.3 EXPANSION LOOPS

A. Manufacturers:
1. Metraflex Metraloop.
2. Twin Cities Hose Seismic 'V' Connector.
B. Provide flexible expansion loops of size to match piping in which installed as shown on the Drawings.
C. Flexible loops shall be designed to impart no thrust loads on the pipe anchors.
D. The loop shall consist of two flexible sections of hose and braid, two 90 degree elbows and a 180 degree return. Hose and braid shall be T304 stainless steel. Fittings shall be carbon steel. Provide connection ends to match piping fitting requirements.
E. Expansion loops shall be designed for 4 inches of movement in all directions and 4" axial movement. Maximum working pressure 150 PSI at 70 degrees.
F. Install at all locations where piping crosses building seismic expansion joints.
G. Expansion loops shall be certified for fluid/gas being transported for use in seismic applications.

2.4 EXPANSION LOOPS - HOSE AND BRAID

A. Manufacturers:
1. The Metraflex Company; Metraloop: www.metraflex.com/#sle.
2. Unisource Manufacturing, Inc; V-Loop: www.unisource-mfg.com/#sle.
B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support brackets and plugged drain port for steam service.
C. Maximum Allowable Motion: 2 inch in the x, y, and z planes with no thrust loads to the building structure.

D. Maximum Working Pressure: 150 psi at 800 degrees F.
E. Construction: Class 150, schedule 40, stainless steel hose and braid assembly with carbon steel fittings, including elbows and flanged end connections sized to match pipe segment.
    1. Selected Product to Accommodate:
        a. Angular Rotation: 15 degrees.
        b. Force developed by 1.5 times specified maximum allowable operating pressure.
    2. Provide necessary accessories including, but not limited to, swivel joints.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
D. Anchor pipe to building structure where indicated or required. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
E. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.
F. Install seismic expansion loops at all points where piping crosses building expansion joints.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applications.
B. Angle valves.
C. Ball valves.
D. Butterfly valves.
E. Check valves.
F. Gate valves.
G. Globe valves.
H. Lubricated plug valves.

1.2 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
B. Section 22 10 05 - Plumbing Piping.

1.3 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Non-rising stem.
E. OS&Y: Outside screw and yoke.
F. PTFE: Polytetrafluoroethylene.
G. RS: Rising stem.
H. SWP: Steam working pressure.
I. TFE: Tetrafluoroethylene.
J. WOG: Water, oil, and gas.

1.4 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.
D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
G. ASME B31.9 - Building Services Piping; 2020.

H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025.
I. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
K. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015 (Reapproved 2021).
L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
M. AWWA C606 - Grooved and Shouldered Joints; 2022.
N. MSS SP-45 - Drain and Bypass Connections; 2020.
O. MSS SP-67 - Butterfly Valves; 2022.
P. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
Q. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
R. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
S. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.
T. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
U. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.
V. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
W. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.
X. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
Y. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.5 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
D. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1.6 QUALITY ASSURANCE

A. Manufacturer:
   1. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Throttling: Provide globe, angle, ball, or butterfly.
   3. Swing Check (Pump Outlet):
      a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
      b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
      c. 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
B. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
C. Required Valve End Connections for Non-Wafer Types:
   1. Steel Pipe:
      a. 2 inch and Smaller: Threaded ends.
      b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
      c. Grooved-End Steel Piping: Grooved.
   2. Copper Tube:
      a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
      b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
D. Domestic, Hot and Cold Water Valves:
   1. All sizes:
      a. Bronze and Brass: Provide with solder-joint or threaded ends.
      b. Bronze Angle: Class 125, bronze disc.
      c. Ball: Two piece, full port, brass with brass trim.
      d. Bronze Swing Check: Class 125, bronze disc.
      e. Bronze Gate: Class 125, NRS.
E. Gas Valves:
   1. All sizes:
      a. Bronze: Provide with threaded ends.
      b. Ball: One piece, full port, bronze with bronze trim.
      c. Lubricated Plug: Class 125, regular gland.

2.2 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
B. Valve Sizes: Match upstream piping unless otherwise indicated.
C. Valve Actuator Types:
   1. Gear Actuator: Quarter-turn valves 8 inch and larger.
   2. Handwheel: Valves other than quarter-turn types.
   3. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.
   4. Wrench: Plug valves with square heads.
D. Insulated Piping Valves: With 2 inch stem extensions and the following features:

1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: Extended neck.
4. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. Building Services Piping Valves: ASME B31.9.

G. Potable Water Use:
1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE, ANGLE VALVES

A. Class 125; CWP Rating: 200 psi:
1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. End Connections: Pipe thread.
4. Stem: Bronze.
5. Disc: Bronze.
6. Packing: Asbestos free.
7. Handwheel: Bronze or aluminum.

2.4 BRASS, BALL VALVES

A. Two Piece, Full Port with Brass Trim and Threaded or Soldered Connections:
1. Comply with MSS SP-110.
2. Seats: PTFE.
3. Ball: Chrome-plated brass.

2.5 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze Trim:
1. Comply with MSS SP-110.

2. WSP Rating: 150 psi.
3. WOG Rating: 600 psi.
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Stem: Bronze, blowout proof.
8. Ball: Chrome plated brass.

2.6 BRONZE, LIFT CHECK VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.
B. Class 125:
   1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
   2. CWP Rating: 200 psi.
   3. Design: Vertical flow.
   4. Body: Comply with ASTM B61 or ASTM B62, bronze.
   5. End Connections: Threaded.

2.7 BRASS, INLINE CHECK VALVES

A. Class 150:
B. Maximum Service Temperature: 250 degrees F.
C. Body: Forged brass.
D. Disc: Forged brass.
E. Seal: PTFE, bubble-tight.
F. End Connections: Press.

2.8 BRASS, HORIZONTAL SWING CHECK VALVES

A. Class 125, Threaded End Connections:
   1. WOG Rating: 200 psi.
   2. Body: Forged brass.
   3. Disc: Forged brass.
   4. Hinge-Pin, Screw, and Cap: Forged brass.

2.9 BRONZE, SWING CHECK VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.
B. Class 125:
   1. Pressure and Temperature Rating: MSS SP-80, Type 3.
   2. Design: Y-pattern, horizontal or vertical flow.
   3. WOG Rating: 200 psi.
   4. Body: Bronze, ASTM B62.
   5. End Connections: Threaded.

6. Disc: Bronze.

2.10 BRONZE, GATE VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.
B. NRS (Non-rising Stem) or OS & Y (Rising Stem):
   1. Comply with MSS SP-80, Type I.
   2. Class 125: CWP Rating 200 psig.
   3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
   4. Ends: Threaded or solder joint joint.
   5. Stem: Bronze.
   6. Disc: Solid wedge; bronze.
   7. Packing: Asbestos free.
   8. Handwheel: Malleable iron, bronze, or aluminum.

2.11 LUBRICATED PLUG VALVES

A. Regular Gland with Flanged Ends:
   1. Comply with MSS SP-78, Type II.
   2. Class 125: CWP Rating: 200 psi.
   3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
   4. Pattern: Regular or short.
   5. Plug: Cast iron or bronze with sealant groove.

PART 3 EXECUTION

3.1 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
B. Verify valve parts to be fully operational in all positions from closed to fully open.
C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
D. Should valve is determined to be defective, replace with new valve.

3.2 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
C. Provide minimum 12"x12" access doors for valves concealed behind rigid surfaces within building. Coordinate access door requirements with Div. 1.
D. Install check valves where necessary to maintain direction of flow as follows:
   1. Lift Check: Install with stem plumb and vertical.
   2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Strut systems for pipe or equipment support.
B. Beam clamps.
C. Pipe hangers.
D. Pipe rollers and roller supports.
E. Pipe supports, guides, shields, and saddles.
F. Seismic bracing hardware.
G. Nonpenetrating rooftop supports for low-slope roofs.
H. Anchors and fasteners.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.
D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
N. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.
B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
E. Fire Resistance: Provide hardware rated for 120 minutes resistance unless specifically indicated by the authority having jurisdiction.
F. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
    1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
    2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

2.2 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
    1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
    2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
B. Hanger Rods:
    1. Threaded zinc-plated steel unless otherwise indicated.
    2. Minimum Size, Unless Otherwise Indicated or Required:
        a. Equipment Supports: 3/8 inch diameter.

b. Piping up to 4 inch: 3/8 inch diameter.
c. Piping larger than 4 inch: 1/2 inch diameter.
d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:
1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.3 NOT USED

2.4 PIPE HANGERS

A. J-Hangers, Adjustable:
1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

B. Swivel Ring Hangers, Adjustable:
1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
3. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

C. Clevis Hangers, Adjustable:
1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.5 PIPE CLAMPS

A. Riser Clamps:
1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.

B. Extension Split Pipe Clamp:
1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
3. Provide hanger rod and nuts of the same type and material for a given pipe run.
4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
D. Strut Clamps:

1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.

E. Insulation Coupling:
1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper or zinc finish.

2.6 PIPE ROLLERS AND ROLLER SUPPORTS

A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
B. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

2.7 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
B. Stanchions:
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

C. U-Bolts:
1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.

D. Pipe Alignment Guides:
1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
2. Pipe Sizes 10 inch and Larger: Roller type.

E. Pipe Shields for Insulated Piping:
1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
2. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Service Temperature: Minus 40 to 178 degrees F.
e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

F. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up to 122 degrees F:
a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
b. Support From Below: MSS SP-58 types 35 through 38.

3. Operating Temperatures from 122 to 446 degrees F:
   a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
   b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
   c. Sliding Support: MSS SP-58 types 35 through 38.

G. Pipe Supports, Thermal Insulated:
   1. General Requirements:
      a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
      b. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
      c. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
      d. Provide pipe supports for 1/2 to 30 inch iron pipes.
      e. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
   2. PVC Jacket:
      a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
      b. Minimum Service Temperature: Minus 40 degrees F.
      c. Maximum Service Temperature: 180 degrees F.
      d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
      e. Minimum Thickness: 60 mil, 0.06 inch.

2.8 SEISMIC BRACING HARDWARE

A. Cable Sway Bracing Systems:
   1. Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
   2. Provide cable wire and end-fixing as required to hold minimum weight of 100 lb.

2.9 NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS

A. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
B. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
C. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
D. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

2.10 ANCHORS AND FASTENERS

A. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
B. Hollow Stud Walls: Use toggle bolts.
C. Steel: Use beam clamps, machine bolts, or welded threaded studs.
D. Sheet Metal: Use sheet metal screws.
E. Wood: Use wood screws.
F. Plastic and lead anchors are not permitted.
G. Powder-actuated fasteners are not permitted.
H. Hammer-driven anchors and fasteners are not permitted.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive support and attachment components.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
D. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
H. Equipment Support and Attachment:
    1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
    2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
    3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
    4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
J. Secure fasteners according to manufacturer's recommended torque settings.
K. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.
B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Pipe markers.
D. Underground warning tape.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
C. Product Data: Provide manufacturers catalog literature for each product required.
D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Heat Transfer Equipment: Nameplates.
B. Major Control Components: Nameplates.
C. Piping: Pipe markers.
D. Pumps: Nameplates.
E. Small-sized Equipment: Tags.
F. Tanks: Nameplates.
G. Valves: Tags and ceiling tacks where located above lay-in ceiling.
H. Water Treatment Devices: Nameplates.

2.2 MANUFACTURERS

A. Brady Corp.
B. Seton Identification Products.

2.3 NAMEPLATES

A. Description: Laminated piece with up to three lines of text.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Plastic: Comply with ASTM D709.

2.4 TAGS

A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.
B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

2.5 PIPE MARKERS

A. Comply with ASME A13.1.
B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completly around pipe and overlapped.
C. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

2.6 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil, 0.004 inch.
C. Legend: Type of service, continuously repeated over full length of tape.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.2 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags in clear view and align with axis of piping
C. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
D. Identify domestic hot water heating equipment, including pumps, etc. with plastic nameplates.
E. Identify valves in main and branch piping with tags.

F. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
G. Identify all medium pressure gas piping (over 11" W.C. to 5 PSI pressure) with pressure contained within piping system (for example: "MPG 5 PSI")

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.
B. Piping insulation.
C. Glass fiber insulation.
D. Jacketing and accessories.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
H. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.
I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
J. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.
K. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.
B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.2 GLASS FIBER INSULATION

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufusa.com.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
B. Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible.
   1. 'K' value: ASTM C 177, 0.22 to 0.28 at 100 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.
C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.
D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
   2. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
   3. Owens Corning Flex Tubing
B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible and sheet for equipment and other surfaces.
   1. 'K' value: ASTM C 177; 0.27 at 75 degrees F.
   2. Minimum Service Temperature: Minus 40 degrees F.
   3. Maximum Service Temperature: 220 degrees F.
   4. Maximum Moisture Absorption - Pipe Insulation: 3.5 percent, by weight, when tested in accordance with ASTM D 1056.
   5. Water Vapor Permeability: 0.20 perm-inches, when tested in accordance with ASTM E 96.
   6. Connection: Waterproof vapor barrier adhesive.
C. Elastomeric Foam Adhesive:
D. Insulation Exposed to the Weather: Finish with two coats Armstrong white Armaflex finish. Provide aluminum jacketing.

2.4 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:
   1. Manufacturers:
      a. Proto Corporation, Proto-Wrap 30 LoSmoke.
      b. Johns Manville Corporation: www.jm.com.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.
B. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch sheet.
   3. Finish: Embossed.
   4. Joining: Longitudinal slip joints and 2 inch laps.
   5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
   6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.
B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Exposed Piping: Locate insulation and cover seams in least visible locations.
C. Glass fiber insulated pipes conveying fluids below ambient temperature:
    1. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with molded PVC fitting covers.
D. Glass fiber insulated pipes conveying fluids above ambient temperature:
    1. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with molded PVC fitting covers.
E. Inserts and Shields:
    1. Application: Piping 1-1/2 inches diameter or larger.
    2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
    3. Insert Location: Between support shield and piping and under the finish jacket.
    4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
    5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, use a UL rated fire penetration assembly, 3M or equal.
G. Pipe in Supply Air Plenum or Finished Spaces: Finish with PVC jacket and fitting covers.
H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
I. Exterior Applications (exposed to the weather): Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 SCHEDULES

A. Plumbing Systems:
    1. Domestic Hot and Tempered Water Supply:
        a. Glass Fiber Insulation:
            1) Pipe Size Range: 1-1/2 inch and larger.
                (a) Thickness: 2 inch.
            2) Pipe Size Range: 1 inch and smaller.
                (a) Thickness: 1-1/2 inch.
    2. Domestic Cold Water Located in Unheated Areas:
        a. Glass Fiber Insulation:
            1) Pipe Size Range: 1-1/2 inch and larger.
                (a) Thickness: 1 inch.

2) Pipe Size Range: 1 inch and smaller.
   (a) Thickness: 3/4 inch.

END OF SECTION

SECTION 22 08 00

PLUMBING COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the Work of this Section.
B. Specific commissioning requirements are given in the following sections of these specifications. It is the contractor's responsibility to coordinate all HVAC systems testing with the GC and all other trades performing related testing services. The division 22 contractor shall provide all T24 required testing by what T24 calls "Certified Acceptance Test Technician". All such tests shall be provided to the districts CxA for inclusion into the CxA reports and submitted according to T24 requirements.
    1. 01 91 00 - General Commissioning Requirements
    2. 26 08 00 - Electrical Commissioning Requirements
    3. 23 08 00 - Mechanical Commissioning Requirements
    4. ASHRAE Guideline 0-2019 or superseding ASHRAE guideline
    5. SUBMITALS
        a. General:
            1) Comply with Section –Submittal Procedures.
            2) See submittal requirements in Section 01 91 00–General Commissioning Requirements
            3) Prior to pre-functional testing:
                (a) Provide a TAB plan for approval by the CxA
                (b) Provide all Pre-Functional Tests for approval to the CxA
    6. COORDINATION
        a. The Contractor shall coordinate all testing and balancing and major equipment startup and installation with the Commissioning Provider (CxA) and the CM.
        b. For the Plumbing domestic water equipment, the Contractor shall provide a short discussion of the control of the plumbing equipment during the mechanical or electrical training conducted by others.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Trade Contractor for the equipment being tested.
B. Datalogging equipment or software required to test equipment will be provided by the contractor, if required, but shall not become the property of the Owner.
C. All testing equipment shall be of sufficient quality and accuracy to test or measure system performance required by the Contract Documents.

PART 3 EXECUTION

3.1 TESTING PREPARATION

A. General Procedures are described in Section 01 91 00 – General Commissioning Requirements.
B. Contractor shall perform all pre-functional performance tests with the tests approved by the CxA. The CxA and the owner shall be advised of all tests as required in this section and by the general commissioning requirements in 01 91 00.
C. Pre-functional Checklists shall be completed and provided to the CxA for the following Plumbing systems:
    1. Contractor to develop, fill out and sign approved pre-functional checklists according to 01 91 00 for the following equipment and systems .These tests shall be provided even if the CxA does not provide related Functional performance tests for these systems:
        a. Domestic Hot Water System
        b. Potable water system and booster pumps, as applicable
            1) Contractor shall certify that Plumbing systems, subsystems, and equipment are completed, calibrated, and started based on the tests verified and approved by the CxA.
D. FUNCTIONAL PERFORMANCE TESTING
    1. General procedures are described in the Division 01 Section "General Commissioning Requirements." 01 91 00
    2. Contractor shall execute all functional performance tests provided by the Commissioning Provider. No functional tests shall be performed without the CxA present.
    3. The details of the functional performance tests shall be reviewed and refined during the construction phase by the CxA. The final test will be provided to the contractor at least 5 business days before the test is conducted.
E. ELECTRONIC DOCUMENT REQUIREMENTS
    1. All working documents shall be provided in electronic format whenever feasible. Hard copies are only permissible if soft copies of the documents are not available.
    2. In addition to the hard copy requirements required in this section, at least all final documents shall be provided un pdf format, organized and tabulated identical to any hard copies provided. Coordinate media requirements with the owner at the time of submission

END OF SECTION

SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.
B. Sanitary waste piping, above grade.
C. Drains.
D. Domestic water piping, buried within 5 feet of building.
E. Domestic water piping, above grade.
F. Natural gas piping, buried within 5 feet of building.
G. Natural gas piping, above grade.
H. Pipe flanges, unions, and couplings.
I. Pipe hangers and supports.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
C. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
D. Section 22 07 19 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing; 2019.
B. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
F. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.
G. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.
H. ASME B31.1 - Power Piping; 2024.
I. ASME B31.9 - Building Services Piping; 2020.
J. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.
K. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.
L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
M. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.
O. ASTM B32 - Standard Specification for Solder Metal; 2020.
P. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.
Q. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
R. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.
S. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
T. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.
U. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.
V. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.
W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
X. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
Y. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
Z. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.
AA. AWWA C651 - Disinfecting Water Mains; 2023.
BB. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.
CC. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.
DD. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
EE. MSS SP-67 - Butterfly Valves; 2022.
FF. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
GG. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
HH. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
II. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
C. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State of California, standards.
B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of California plumbing code.
B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
C. Conform to applicable code for installation of backflow prevention devices.
D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED

A. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies. Heavy duty, Husky SD4000, .015 inch thick 304 stainless steel shield, 4-band coupling.

2.3 DRAIN PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
B. Copper Tube: ASTM B 306, DWV or ASTM B 88 (ASTM B 88M), Type M (C), Drawn (H).
   1. Application: Condensate drains inside building (non-acidic).
   2. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.
   3. Joints: ASTM B32, alloy Sn50 solder.
C. Steel Pipe: ASTM A 53 Schedule 40, galvanized.
   1. Application: Condensate drains outside building (non-acidic).

2. Threaded Joints: ASME B16.3 malleable iron fittings.

2.4 WATER PIPING, BURIED

A. Copper Pipe: ASTM B 42, hard drawn, Type K.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: AWS A5.8M/A5.8, BCuP copper and silver braze.

2.5 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy.
2. Joints: For sizes 1-1/2" and smaller, ASTM B 32, alloy Sn95 solder.
3. Joints: For sizes 2" and larger, AWS A5.8, BCuP5 silver braze.
B. Provide full solder cup for all fittings.
C. Schedule 40 Screwed Brass: Capped or plugged outlets.

2.6 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Polyethylene Pipe: ASTM D2513, SDR 11.
1. Fittings: ASTM D2683 or ASTM D2513 socket type.
2. Joints: Fusion welded.

2.7 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.
1. Fittings: ASTM A234/A234M, wrought steel welding type.
2. Joints: ASME B31.1, welded.
3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.8 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Pipe size 2" and smaller: Malleable iron threaded fittings.
2. Pipe size 2-1/2" and larger: Steel butt welded fittings.
3. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, forged steel welding type.
4. Joints: Threaded or welded to ASME B31.1.
B. Flexible Gas Piping:
1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
2. Comply with ASTM E84.
3. Fittings: Provided by piping system manufacturer.

2.9 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 2 Inches and Under:
1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
B. Flanges for Pipe Sizes Over 2 inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.10 PIPE HANGERS AND SUPPORTS

A. See Section 22 05 29 for additional requirements.

2.11 GAS PRESSURE REGULATING VALVES

A. Provide single stage, steel jacketed, corrosion resistant gas pressure regulating valves with atmospheric vent and elevation compensator sized for inlet and outlet pressures , specific gravity and volume indicated on the drawings.
B. Compliance requirements:
   1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
   2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.
C. For sizes 2" and smaller: threaded ends.
D. For sizes 2-1/2" and larger: flanged ends.
E. Provide high and low pressure cutout and internal relief for each regulator.

2.12 SEISMIC GAS SHUTOFF VALVES

A. Manufacturers: Safetquake, Quakemaster or equal.
B. Valve is fabricated of aluminum, incorporates a stainless steel ball and bubble level, is vertically mounted, has a single step manual reset lever, operates at ambient temperature range of -40 deg F to +150 Deg F, minimum pressure .5 psi and maximum allowable pressure of 60 psi.
C. Valves actuates within 5 seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of anyone of the following: (1) 0.70g and period of 0.13 second, (2) 0.40g and period of 0.20 second, (3) 0.30g and period of 0.40 second, (4) 0.25g and period of 1.00 second.
D. Meets or exceeds California standard, ANSI (Z21 1995), California Office of State Architect (Label Numbers CA-OSA 19.49 and CA-OSA 27.02, IAPMO, UPC (file 3D94), AGA P-70-2A, U.L. Building and Safety RR 4996.

2.13 WATER PRESSURE REDUCING VALVES

A. 2 inch and Smaller:
   1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
   2. Pressure Reducing Pilot-Operator:
      a. Operating Range: 5 to 50 psi.
      b. Connected into brass or bronze pilot piping and fittings.
      c. Fixed flow restrictor, pressure gauges, and isolation valves.
B. 2 inch and Larger:
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2. Pressure Reducing Pilot-Operator:
   a. Operating Range: 5 to 50 psi.
   b. Connected into brass or bronze pilot piping and fittings.
   c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.14 PRESSURE RELIEF VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
B. Temperature and Pressure:
   1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.15 STRAINERS

A. Size 2 inch and Smaller:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
H. Provide access where valves and fittings are not exposed.
I. Provide anodeless transition riser at gas piping transition from below grade to above grade.

J. All natural gas piping exposed to outdoors shall be primed and painted, color by architect.
K. All ABS and PVC pipe material exposed to outdoors shall be primed and painted, color by architect.
L. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
M. Install valves with stems upright or horizontal, not inverted. See Section 22 05 23.
N. Install water piping to ASME B31.9.
O. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
P. Sleeve pipes passing through partitions, walls, and floors.
Q. Pipe Hangers and Supports:
    1. Install in accordance with ASME B31.9.
    2. Support horizontal piping as indicated.
    3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
    4. Place hangers within 12 inches of each horizontal elbow.
    5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
    6. Provide copper plated hangers and supports for copper piping.
    7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
    8. Support cast iron drainage piping at every joint.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.
B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.5 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.
B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.
F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inch to 1-1/4 inch:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inch to 2 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inch to 3 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 1/2 inch.
      d. Pipe Size: 4 inch to 6 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION

SECTION 22 10 06

PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floor drains.
B. Cleanouts.
C. Water hammer arrestors.
D. Trap primers.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 22 10 05 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor Drains; 2022.
B. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.
C. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
D. NSF 372 - Drinking Water System Components - Lead Content; 2022.
E. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
D. Project Record Documents: Record actual locations of equipment, cleanouts, water hammer arrestors.
E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of California plumbing code.
B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
C. Conform to applicable code for installation of backflow prevention devices.

D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 REFER TO PLUMBING SCHEDULE FOR PLUMBING PIPING SPECIALTIES

NOT LISTED HEREIN.

2.3 DRAINS

A. Manufacturers:
   1. Josam Company: www.josam.com/#sle.
   2. MIFAB, Inc: www.mifab.com/#sle.
   3. Jay R. Smith Manufacturing Company.
   4. Zurn Industries, LLC: www.zurn.com/#sle.

B. Downspout Nozzles:
   1. Bronze round with straight bottom section. Zurn Z-199.

C. Floor Drain (FD):
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
   2. Provide accessories suitable for wood raised floor installation.

D. Floor Sink (FS):
   1. Lacquered cast iron body with white acid resisting porcelain interior and top complete with aluminum anti-splash bottom dome strainer, square slotted medium duty half grate, anchor and seepage flange.

2.4 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.

B. Cleanouts at Exterior Surfaced Areas:
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas :
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and nickel bronze round gasketed scored cover in service areas and

round or square nickel bronze gasketed depressed cover to accept floor finish in finished floor areas. Zurn ZN-1400.

E. Cleanouts at Interior Finished Wall Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw. Zurn Z-1441 or Z-1443.
F. Cleanouts in concealed aboveground cast iron soil or waste lines: Zurn Z-1440A with raised head ABS plastic plug.

2.5 TRAP PRIMERS

A. Provide trap primers, 1/2 inch size, where indicated on drawings. Provide with built-in air gap and install 1/2" shutoff valve. PVC housings are not acceptable. Install trap primer line with 1/4" per foot slope to insure full drainage to floor drain or floor sink. Install tap primer behind wall with access door.
B. Provide a distribution unit with feeder piping for a maximum of four (4) traps where multiple traps are serviced by a single trap primer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Extend cleanouts to finished floor or wall surface as indicated on plans. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
C. Encase exterior cleanouts in concrete flush with grade.
D. Install cleanouts in all horizontal soil and waste piping at 100 feet maximum spacing inside building, 100 feet maximum spacing outside building, at every 135 degree change of direction and where shown on Drawings.
E. Install two way cleanout in building drain (waste line leaving the building) just outside of the building.
F. Install cleanouts in waste drops from each urinal and sink.
G. Install cleanouts in rain water (storm drain) drops 18 inches above finished floor. For concealed rainwater drops extend cleanout to building exterior for access.
H. Install floor cleanouts at elevation to accommodate finished floor.
I. Pipe relief from backflow preventer to nearest drain.
J. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to and water closets and as shown on plans.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial electric water heaters.
B. In-line circulator pumps.
C. Condensate removal pumps.
D. Expansion Tanks.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.3 REFERENCE STANDARDS

A. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less; 2019, with Errata (2020).
B. ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous; 2019.
C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.
E. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.4 REFERENCE STANDARDS

A. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 1996.
B. NFPA 70 - National Electrical Code; National Fire Protection Association; 1999.

1.5 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data:
    1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
    2. Provide electrical characteristics and connection requirements.
C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

A. See Division 1 for additional warranty requirements.
B. Manufacturer Warranty: Provide 5-year manufacturer warranty for domestic water heaters. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Commercial Electric Water Heaters:
   1. Manufacturers:
      a. Bradford White Corporation: www.bradfordwhite.com/#sle.
      b. A.O. Smith Water Products Co<>: www.hotwater.com/#sle..
      c. State Water Heaters: www.statewaterheaters.com.
   2. Type: Factory-assembled and wired, electric, vertical storage.
   3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
   4. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches foam plastic encased in corrosion-resistant steel jacket; baked-on enamel finish.
   5. Accessories:
      a. Water Connections: Brass.
      b. Dip Tube: Brass.
      c. Drain valve.
      d. Anode: Magnesium.
      e. Temperature and Pressure Relief Valve: ASME labeled.
   6. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

2.2 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
   1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
   2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
   3. Taco, Inc[<>]: www.tacocomfort.com/#sle.
B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
C. Impeller: Bronze.
D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
E. Seal: Carbon rotating against a stationary ceramic seat.
F. Drive: Flexible coupling.

2.3 CONDENSATE REMOVAL PUMPS

A. Manufacturers:
   1. Liberty Pumps Inc: www.libertypumps.com/#sle.
   2. Little Giant Pumps: www.littlegiant.com
   3. Blue Diamond Pumps Inc: www.bluediamondpumps.com
B. Construction: Commercial grade, nonferrous pump with stainless steel shaft, integral discharge check valve, integral float switch, safety switch, thermoplastic reservoir, motor assembly, and power cord with ground.
C. Safety: UL 778.

2.4 **EXPANSION TANK**

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
   3. Taco, Inc: www.tacocomfort.com/#sle.
B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 38 psig.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.
B. Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.
C. Provide and install CPVC piping for combustion air intake and flue for gas fired water heaters where scheduled and as shown on the drawings. Install in accordance with manufacturer's installation instructions.
D. Pumps:
   1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
   2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
   3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush valve water closets.
B. Wall hung urinals.
C. Lavatories.
D. Sinks.
E. Indoor drinking fountains.
F. Service sinks.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 22 10 05 - Plumbing Piping.
C. Section 22 10 06 - Plumbing Piping Specialties.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).
B. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
C. ASME A112.18.1 - Plumbing Supply Fittings; 2024.
D. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).
E. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.
F. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.
G. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.
H. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2020.
I. ASSE 1016 - Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations; 2017 (Reaffirmed 2021).
J. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.
K. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.
L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
M. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
N. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of California plumbing code.
B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
C. Conform to applicable code for installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on-site in factory packaging. Inspect for damage.
B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. See Division 1 for additional warranty requirements.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 GENERAL REQUIREMENTS:

A. Refer to Architectural drawings for exact locations, fixture mounting heights and ADA accessibility requirements.
B. Insulate water supplies, stops, and p-traps below accessible lavatories and sinks with molded single piece removable insulation covers, foam, fire resistant, Truebro, or equal. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. Install insulation covers in accordance with CBC access requirements.
C. Provide compression shutoff control stop valves with IPS inlets and threaded brass nipples at pipe connection on water supplies to each fixture. Provide stops with lock shield loose key and key handle for each stop. For combination fixtures, provide with compression stop and IPS inlet on each water supply fitting.

D. Wall hung fixtures including water closets, urinals, lavatories, and drinking fountains to be supported by floor mounted fixture carriers, with mounting feet securely anchored to floor per carrier manufacturer's recommendations. Fixture carriers to be JR Smith, Mifab, Zurn, Josam, or per fixture manufacturer.
E. Provide cast brass escutcheons, except escutcheons exposed to view shall have chrome plated finish.
F. Provide chromium-plated finish on fittings and accessories exposed to view.
G. Fixture fittings and trim: Conform to ASME A112.18.1M and ASME A112.19.5, as applicable.
H. Zinc-alloy or plastic handles are not permitted for faucets and valves.
I. Provide special roughing-in for wheelchair fixtures.
J. Lavatory flow rates not to exceed 0.5 GPM.
K. Water closet flush flow rates not to exceed 1.28 GPF.
L. Urinal flush flow rates not to exceed 0.125 GPF.
M. Provide water hammer arrestors at end of pipe runs to two or more fixtures, properly sized with sufficient displacement volume to dissipate calculated energy in the piping systems. Locate in accessible location or provide access panel with location approved by Architect.
N. Fixture dimensions specified are nominal.

2.3 SEE PLUMBING SCHEDULE FOR FIXTURE REQUIREMENTS.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
B. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.
B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
C. Install components level and plumb.
D. Install and secure fixtures in place with wall carriers and bolts.

3.4 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.5 CLEANING

A. Clean plumbing fixtures and equipment.

END OF SECTION

SECTION 23 05 10

MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. References.
B. Description of Work.
C. Drawings and Specifications.
D. Industry Standards and Codes.
E. Site Examination.
F. Permits, Fees and Utility Connections.
G. Coordination of Work.
H. Progress of Work.
I. Submittals
J. Operation and Maintenance Manuals.
K. Project Record Documents.
L. Warranty.
M. Quality and Care
N. Access Doors.
O. Starting Equipment and Systems.

1.2 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
C. The requirements of this Section apply to all Work of Division 23.

1.3 REFERENCES

A. ANSI - American National Standards Institute.
B. ASTM - American Society for Testing Materials.
C. CEC - California Electric Code.
D. NEMA - National Electric Manufacturers' Association.
E. NFPA - National Fire Protection Association.
F. OSHA - Occupational Safety and Health Act.
G. UL - Underwriters' Laboratories.
H. See detailed References that are listed in individual sections.

1.4 DESCRIPTION OF WORK

A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing

operations necessary for the installation of the complete Mechanical System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.

B. The work shall also include the completion of details of mechanical work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

1.5 DRAWINGS AND SPECIFICATIONS

A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, ductwork and other mechanical work. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.

B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.

C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.

D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.6 INDUSTRY STANDARDS AND CODES

A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.

B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
   1. California Building Code, 2022.
   2. California Mechanical Code, 2022.
   3. California Plumbing Code, 2022.
   4. California Electrical Code, 2022.
   5. National Fire Protection Association.
   6. California Fire Code, 2022.
   7. California State Fire Marshal.
   8. Occupational Safety and Health Administration, including CAL-OSHA.
   9. California Energy Code, 2022.
   10. California Green Building Standards Code, 2022.
   11. State of California Code of Regulations, Title 24.
   12. Other applicable state laws.

C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes,

furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.

D. No material or product installed as a part of the Work shall contain asbestos in any form.

1.7 SITE EXAMINATION

A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

1.8 PERMITS, FEES AND UTILITY SERVICES

A. Contractor shall pay for and obtain all permits and service required in the installation of this work.

B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

1.9 COORDINATION OF WORK

A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.

B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.

C. Arrange mechanical work in a neat, well-organized manner with the piping, conduit, and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.

D. Verify the location of all equipment, and devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

1.10 PROGRESS OF WORK

A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

A. Mechanical systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
B. Mechanical systems and equipment shall include, but are not limited to, all piping, heating and ventilating equipment, electrical and control panels, conduits and other components.
C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

1.12 SUBMITTALS

A. See Division 1 for additional submittal procedures.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
C. Shop Drawing Submittals: Prepared specifically for this Project.
D. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.
E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
F. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.
G. Maintain a copy of the fire and smoke damper installation instructions on site for use by the Inspector of Record.

1.13 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
B. LP Consulting Engineers, Inc. will consider requests for substitutions only within 7 days after date of Agreement.
C. Substitutions may be considered when a product becomes unavailable through no fault of the .
D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
F. A request for substitution constitutes a representation that the submitter:
    1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
    2. Will provide the same warranty for the substitution as for the specified product.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner and LP Consulting Engineers, Inc. for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.

G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.

I. Substitution Submittal Procedure:
1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The LP Consulting Engineers, Inc. will notify in writing of decision to accept or reject request.
4. Present each substitution individually. If a proposed substitute in not found to be acceptable, then the specified item shall be supplied.

1.14 OPERATION AND MAINTENANCE MANUALS

A. See Division 1 for Closeout Submittals for Operation and Maintenance Manual requirements.

B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.

C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
1. Ventilating Systems.
2. Air Conditioning Systems.
3. Piping Systems.
4. Temperature Controls Systems.
5. Motors.
6. Testing, Adjusting, and Balancing Reports.

D. Provide manufacturer's model number, design data, capacities, etc. for each piece of mechanical equipment furnished as a part of the Work.

E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.

F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.

G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided.

Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.

H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

1.15 PROJECT RECORD DOCUMENTS

A. See Division 1 for Closeout Procedures.
B. Provide red-lined drawings accurately showing location of equipment and devices and size and routing of ductwork. Include notes explaining installed condition for complete understanding.

1.16 QUALITY ASSURANCE

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from LP Consulting Engineers, Inc. before proceeding.
D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have Work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

1.17 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.18 WARRANTY

A. See Division 1 for additional warranty requirements.
B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 QUALITY AND CARE

A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).

B. All capacities, sizes and efficiency ratings shown on the drawing are minimum.
C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.
D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.
E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
F. Inspect and report concealed damage to carrier within their required time period.
G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.
H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

2.2 ACCESS DOORS

A. Coordinate access door requirements with Division 1. The more stringent requirements shall govern.
B. Provide access doors where access through floors, walls or ceilings is required to access mechanical, plumbing, control system components, fire dampers and fire alarm system components (such as smoke detectors, fire/smoke dampers, etc.) or other systems requiring access for maintenance, test or observation.
    1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
    2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.
C. Established standard: Milcor of types listed below. Other acceptable manufacturers: Cesco, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
    1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
    2. Concealed hinges to allow 175 degree opening.
    3. Locks: flush, screw driver operated cam lock(s).
    4. Provide anchoring devices suitable for the construction into which the doors are framed.
D. Application (as applicable):
    1. In gypsum drywall walls and ceilings: Type DW.
    2. In ceramic tile walls: Type MS (stainless steel).
    3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

PART 3 EXECUTION

3.1 INSTALLATION

A. Access Doors
   1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
   2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
   3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
   4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
   5. Install in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with the requirements within this section.
B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

3.3 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS

A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic piping and duct testing.
   1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
   2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
   3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.
B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
   1. Hydronic Piping: Pressure=125 Psig / Medium= Water / Duration=4 Hours.

3.4 CUTTING AND PATCHING

A. Submit written request in advance of cutting or alteration which affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in

the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.

C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
E. Restore work with new Products in accordance with requirements of Contract Documents.
F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements , to full thickness of the penetrated element.
H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.5 PRIMING AND PAINTING

A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted to match Architectural finsih requirements.
   1. Primer shall be as recommended by the paint manufacturer for each specific application.
   2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 092216 for other acceptable products.
B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except ductwork and piping, or factory primed or finished.
C. Preparation:
   1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
   2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devoe KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
   3. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
   4. Galvanized Surfaces:
      a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
      b. Apply Devoe MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.
   5. Uncoated Steel And Iron Surfaces:
      a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.

b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.

6. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devoe MIRROLAC metal primer or primer recommended by manufacturer.

D. Application:
1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

3.6 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING

A. Start equipment and systems in accordance with manufacturer's written instructions..
B. Adjust for proper operation within manufacturer's published tolerances.
C. Demonstrate proper operation of equipment to Owner's designated representative.
D. Description:
1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.
2. Coordinate all testing and startup procedures with all other trades so that all non-mechanical and non-electrical work is completed and operational so that the specified testing can be performed.
E. Preliminary Work:
1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
a. Proper motor and pump rotation.
b. Flushing and cleaning of the system.
c. Wiring
d. Auxiliary connections
e. Lubrication.
f. Venting.
g. Controls.
h. Installation of filters and strainers.
i. Setting of relief and safety valves .
2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
3. The Contractor shall submit at least 10 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Mechanical equipment. This schedule shall include work on a system by system, floor by floor basis.

4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.
    a. The startup checklist will cover all related crafts, e.g., controls, electrical, mechanical, and a clean environment for equipment startup.
5. The Contractor shall schedule a tour with the Owner's representative and the Engineer to review startup conditions prior to equipment startup. This tour shall take place during the associated Engineer's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Engineer prior to attempting an equipment startup.
6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestartup check sheet.

F. Startup and Commissioning:
1. System Startup and Operation:
    a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.
    b. The Contractor and the factory representative shall check all equipment during initial startup to insure correct rotation, proper lubrication, adequate fluids or air flows, nonoverloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for air and/or water flows throughout without blockages. Air handling systems shall be checked for proper damper connections and positions, aligned and adjusted belt drives, proper lubrication, temporary air filters installed, nonexcessive electrical characteristics and minimal vibration. Other miscellaneous equipment shall be started and operated as described above as applicable. Manufacturer's representative shall submit a preliminary written copy of equipment startup check sheet prior to leaving job site.
    c. After initial startup and operation of systems, the Contractor shall submit a report, showing proper operation before commencement of the final "Operation Test".
    d. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainers, cleanouts, filter replacement, bearing lubrication, packing replacement, and other consumables shall be provided without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Engineer.

G. System Acceptance:

1. General: The system installation shall be complete and tested for proper operation prior to acceptance testing "Operation Test" for the Owners authorized representative. A letter shall be submitted to the Engineer requesting system acceptance. This letter shall certify that all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing shall commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative and pass, the system will be accepted. The warranty period may begin at this time.
2. A certified acceptance test technician (ATT) shall perform and document acceptance testing as applicable per Title 24 sections 120.5 and 130.4. Certificate of Acceptance shall be in PDF format for electronic submission to Authority Having Jurisdiction.

H. Operation Test:
1. Provide all labor, equipment, and materials required to perform test.
2. The test shall occur after all major equipment startup and balance services have been performed as specified. The purpose is to demonstrate that individual pieces of equipment and all related elements operate as one complete system and not to identify incomplete or defective work.
3. All equipment is to be run in an automatic operating position and exercised for 72 hours to verify that they perform in accordance with the specified sequence of operation and designed operation logic.
4. The Engineer's representative shall be notified and may be present for the initiation of the test.
5. A log shall be prepared by the Contractor, to be submitted to the Engineer, of all tests including, but not limited to: time, temperatures, pressures, and other readings to prove all equipment is operating as specified.
6. All temperatures, pressures, status indication, etc., shall be verified by at least one other means of measurement or visual verification of condition.
7. Change set points and simulate conditions as directed to demonstrate:
   a. Ability to control to new set point.
   b. Interface between systems, fire alarm/fire sprinkler systems.
   c. Proper sequence and operation.
   d. Equipment safety systems and all automatic changeover/backup systems and alarms are functioning or will function.
8. If unsatisfactory performance or a system failure is experienced for any reason, the test shall be repeated until 72 hour consecutive hours are achieved. The Engineer's representative shall make all final decisions of a satisfactory test.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Strut systems for pipe or equipment support.
B. Beam clamps.
C. Pipe hangers.
D. Pipe rollers and roller supports.
E. Pipe supports, guides, shields, and saddles.
F. Seismic bracing hardware.
G. Nonpenetrating rooftop supports for low-slope roofs.
H. Anchors and fasteners.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.
D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
N. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of mechanical work.
B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
E. Fire Resistance: Provide hardware rated for 120 minutes resistance unless specifically indicated by the authority having jurisdiction.
F. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
    1. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
    1. Indoor Dry Locations: Use approved equivalent or galvanized steel unless otherwise indicated.
    2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

2.2 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
    1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
    2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
B. Hanger Rods:
    1. Threaded zinc-plated steel unless otherwise indicated.

2. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 3/8 inch diameter.
   b. Piping up to 4 inch: 3/8 inch diameter.
   c. Piping larger than 4 inch: 1/2 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:
   1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.3 NOT USED

2.4 PIPE HANGERS

A. J-Hangers, Adjustable:
   1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

B. Swivel Ring Hangers, Adjustable:
   1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
   2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   3. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

C. Clevis Hangers, Adjustable:
   1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
   2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
   3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
   4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.5 PIPE CLAMPS

A. Riser Clamps:
   1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.

B. Extension Split Pipe Clamp:
   1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
   2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
   3. Provide hanger rod and nuts of the same type and material for a given pipe run.
   4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

D. Strut Clamps:
   1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
   2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.

E. Insulation Coupling:
   1. Two bolt-type clamps designed for installation under insulation.
   2. Material: Carbon steel with epoxy copper or zinc finish.

2.6 PIPE ROLLERS AND ROLLER SUPPORTS

A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
B. Steel Yoke Type: MSS SP-58 type 44, vertically adjustable, nonconductive, and corrosion resistant.
C. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

2.7 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
B. Stanchions:
   1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
   2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
   3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
C. U-Bolts:
   1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.
D. Pipe Alignment Guides, Galvanized steel:
   1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
   2. Pipe Sizes 10 inch and Larger: Roller type.
E. Pipe Shields for Insulated Piping:
   1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   2. General Construction and Requirements:
      a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
      b. Shields Material: UV-resistant polypropylene with glass fill.
      c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
      d. Service Temperature: Minus 40 to 178 degrees F.
      e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
F. Pipe Supports:
   1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2. Liquid Temperatures Up to 122 degrees F:
   a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
   b. Support From Below: MSS SP-58 types 35 through 38.
3. Operating Temperatures from 122 to 446 degrees F:
   a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
   b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
   c. Sliding Support: MSS SP-58 types 35 through 38.

G. Pipe Supports, Thermal Insulated:
1. General Requirements:
   a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
   c. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   d. Provide pipe supports for 1/2 to 30 inch iron pipes.
   e. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
2. PVC Jacket:
   a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
   b. Minimum Service Temperature: Minus 40 degrees F.
   c. Maximum Service Temperature: 180 degrees F.
   d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
   e. Minimum Thickness: 60 mil, 0.06 inch.

2.8 SEISMIC BRACING HARDWARE

A. Cable Sway Bracing Systems:
1. Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
2. Provide cable wire and end-fixing as required to hold minimum weight of 100 lb.

B. NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS
C. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
D. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
E. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
F. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

G. ANCHORS AND FASTENERS
H. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
I. Hollow Stud Walls: Use toggle bolts.
J. Steel: Use beam clamps, machine bolts, or welded threaded studs.
K. Sheet Metal: Use sheet metal screws.
L. Wood: Use wood screws.
M. Plastic and lead anchors are not permitted.
N. Powder-actuated fasteners are not permitted.
O. Hammer-driven anchors and fasteners are not permitted.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive support and attachment components.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
D. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
H. Equipment Support and Attachment:
    1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
    2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
    3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
    4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
J. Secure fasteners according to manufacturer's recommended torque settings.
K. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.
B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Pipe markers.
D. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
C. Product Data: Provide manufacturers catalog literature for each product required.
D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.
B. Air Terminal Units: Nameplates.
C. Control Panels: Nameplates.
D. Fire and/or Smoke Dampers: Ceiling tacks, where located above lay-in ceiling.
E. Heat Transfer Equipment: Nameplates.
F. Major Control Components: Nameplates.
G. Piping: Pipe markers.
H. Pumps: Nameplates.
I. Small-sized Equipment: Tags.
J. Tanks: Nameplates.
K. Thermostats: Nameplates.
L. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Seton Identification Products: www.seton.com/aec.

2.3 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: Air Handling Units, Control panels: 1 inch.
   3. Letter Height: All others: 1/4 inch.
   4. Background Color: Black.
   5. Plastic: Comply with ASTM D709.

2.4 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.5 PIPE MARKERS

A. Color: Comply with ASME A13.1.
B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completly around pipe and overlapped.
C. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

2.6 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.
B. Color code as follows:
   1. Fire Dampers and Smoke Dampers: Red.
   2. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with corrosion resistant chain.
C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
D. Identify fans and filter boxes with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

E. Identify chilled/hot water equipment, including chillers, boilers, pumps, expansion tanks, air separators, etc. with plastic nameplates.
F. Identify air conditioning units, air handling units, heating and ventilating units, exhaust fans, pumps, heat transfer equipment, tanks, fire/smoke damper access doors, and water treatment devices with nameplates. Small devices, such as terminal units, in-line pumps, may be identified with tags.
G. Identify control panels and major control components outside panels with plastic nameplates.
H. Identify thermostats/sensors relating to fan unit and/or zone unit with nameplates.
I. Identify valves in main and branch piping with tags.
J. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
K. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.3 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).
C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).
D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component and include controls contractor to assist in testing, adjusting, and balancing procedures. Submit plan for each phase.
    1. Submit to LP Consulting Engineers, Inc..
    2. Submit to the Commissioning Authority.
    3. Submit four weeks prior to starting the testing, adjusting, and balancing work.
    4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the LP Consulting Engineers, Inc. and other installers to sufficiently understand the design intent for each system.
    5. Include at least the following in the plan:
        a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
        b. List of all air flow measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
        c. Completed planned test sheets listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
        d. Single-line drawings with system test locations.
        e. Identification and types of measurement instruments to be used and their most recent calibration date.

f. Detailed step-by-step procedures for TAB work for each system and issue, including:
   1) SA, RA, EA, OA, for each AHU.
   2) Economizer proportioning and vfd speed adjustiments.
   3) Rechecking.
g. Confirmation of understanding of the outside air ventilation criteria under all conditions.
h. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
i. Method of checking building static and exhaust fan and/or relief damper capacity.
j. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit to LP Consulting Engineers, Inc. within 2 days after completion of testing, adjusting, and balancing.
   2. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   3. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   4. Units of Measure: Report data in I-P (inch-pound) units only.
   5. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
   6. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Engineer.
      g. Project altitude.
      h. Report date.

D. Test and balance shall be performed by an independent test and balance agency.

E. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

F. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC or NEBB.

G. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work and licensed at the .

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. SMACNA (TAB).
B. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 TESTING, ADJUSTING, AND BALANCING AGENCIES

A. RS Analysis Inc.; www.rsanalysis.com; (888-330-1935).
B. Mesa 3; www.mesa3.com; (408-928-3000).
C. Raglen System Balance; www.raglensystembalance.com; (775-747-0100).
D. National Air Balance Company Inc.; www.nabco.biz; (510-623-7000).

3.3 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Fire and volume dampers are in place and open.
   7. Air coil fins are cleaned and combed.
   8. Access doors are closed and duct end caps are in place.
   9. Air outlets are installed and connected.
   10. Hydronic systems are flushed, filled, and vented.
   11. Pumps are rotating correctly.
   12. Proper strainer baskets are clean and in place.

13. Service and balance valves are open.

B. Contractor to inspect ductwork and piping systems at 60% and 90% completion to verify systems are ready for testing and balancing.
C. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
D. Beginning of work means acceptance of existing conditions.

3.4 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to LP Consulting Engineers, Inc. to facilitate spot checks during testing.
B. Provide additional balancing devices as required.

3.5 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust total airflow(s) to within plus 10 percent and minus 5 percent of design.
B. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus 10 percent and minus 10 percent of design.
C. Ventilation Systems: Adjust outside air system components to within plus 10 percent and minus 0 percent of de
D. Hydronic Systems: Adjust to within plus 10 percent and minus 5 percent of design.

3.6 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.
B. Ensure recorded data represents actual measured or observed conditions.
C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

3.7 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
C. Measure air quantities at air inlets and outlets.
D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
F. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
G. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

3.8 TITLE 24 TESTING

A. Complete applicable Title 24 Acceptance Testing as delineated in contract drawings.

3.9 COMMISSIONING

A. See Division 1, 22, 23 and 26 Commissioning specifications for requirements. Coordinate all requirements with Commissioning Agent.
B. Perform prerequisites prior to starting commissioning activities.
C. Assist Commissioning Agent in field verification of test and balance report.
D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

3.10 SCOPE

A. Test, adjust, and balance the following:
1. Air Handling Units.
2. Fans.
3. Air Filters.
4. Air Inlets and Outlets.

3.11 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. Cooling Coils:
1. Location.
2. Service.
3. Manufacturer.
4. Air flow, design and actual.
5. Entering air DB temperature, design and actual.
6. Entering air WB temperature, design and actual.
7. Leaving air DB temperature, design and actual.
8. Leaving air WB temperature, design and actual.

9. Saturated suction temperature, design and actual.
10. Air pressure drop, design and actual.

C. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

D. Return Air/Outside Air/Exhaust Air:
1. Identification/location.
2. Design air flow (determined by inital test)
3. Actual air flow.
4. Design return air flow (determined by inital test)
5. Actual return air flow.
6. Design outside air flow (determined by inital test)
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Actual mixed air temperature.

E. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.
B. Duct liner.
C. Jacketing and accessories.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 23 31 00 - HVAC Ducts and Casings: Ductwork.

1.3 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
G. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
C. The requirements of this Section apply to all Work of Division 23.

1.5 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Owens-Corning Fiberglas; Model [All Service Faced Duct Wrap].
   2. Knauf Insulation: www.knaufinsulation.com.
   3. Johns Manville: www.jm.com/#sle.
B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Duct Application: 2" thick, 3/4 pound density.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.
C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.3 GLASS FIBER, RIGID

A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Knauf Insulation: www.knaufinsulation.com.
3. Johns Manville: www.jm.com/#sle.
4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Density: 3.0 lb/cu ft.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.4 JACKETING AND ACCESSORIES

A. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.020 inch sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.5 DUCT LINER

A. Manufacturers:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Knauf Insulation: www.knaufinsulation.com.
3. Johns Manville: www.jm.com/#sle.
4. Owens Corning Corp: www.owenscorning.com.

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
2. Duct Application (Indoors): 1" thick, 1-1/2 pound density.

3. Duct Application (Outdoors): 2" thick, 1-1/2 pound density.
4. Service Temperature: Up to 250 degrees F.
5. Acoustical Requirements
   a. Sound absorption coefficients of the material (with and/or without erosion resistive coating) shall be greater than or equal to the coefficients listed in the specifications when tested under the specified conditions.
   b. All acoustical measurements shall be performed in accordance with ANSI/ASTM C423 and shall be performed in the ASTM E795 mounting configuration as indicated.
   c. An independent acoustical laboratory shall perform the tests.
   d. The sound absorption coefficient provided by the material shall meet or exceed the following values in each octave band listed:
6. Thickness, 1 inch Hz/Coefficient: 125/.05, 250/.20, 500/.65, 1k/.90, 2k/.95, 4k/.95.

C. Liner Fasteners: Galvanized steel, welded with integral head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.
B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Prime and paint exposed ductwork as required by Architect.
C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
D. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or with standard vapor barrier jacket.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
E. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 100 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Liner shall start within 3 inches of the upstream transverse edges of the liner and 3 inches from the longitudinal joints, and shall be spaced at a maximum of 12 inches on center around the perimeter of the duct (except that they shall be a maximum of 12 inches from a corner break). Elsewhere, they shall be a maximum of 18 inches on center, except that they shall not be placed more than 6 inches from a longitudinal joint of the

liner or 12 inches from a corner break. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.

3. Seal and smooth joints. Seal and coat transverse and longitudinal joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are inside dimensions and do not include consideration for liner thickness.

3.3 SCHEDULES

A. Supply and Return Ducts: Insulate all unlined ducts, except ducts exposed in conditioned spaces.
B. Exterior Applications:
   1. Supply and Return Ducts exposed to outdoors to be internally lined except ductwork conveying direct evaporatively cooled air.
   2. Supply and Return ductwork exposed to outdoors for direct evaporatively cooling systems to be externally insulated. Cover insulation with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
C. Supply and Return Ducts: Install lining within 10 feet of fan on all ductwork and where shown on drawings where longer lining lenghts has been shown.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.
B. Jacketing and accessories.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.
C. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.3 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
C. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
F. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.
G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
H. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.
I. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
J. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
M. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.
B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.2 GLASS FIBER, RIGID

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufusa.com.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
B. Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible.
   1. "K" value: ASTM C 177:
      a. 0.24 to 0.28 at 100 degrees mean rating temperature.
      b. 0.25 to 0.29 at 125 degrees mean rating temperature.
      c. 0.27 to 0.30 at 150 degrees mean rating temperature.
      d. 0.29 to 0.31 at 200 degrees mean rating temperature.
      e. 0.32 to 0.34 at 250 degrees mean rating temperature.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
1. Armacell LLC: www.armacell.us/#sle.
2. K-Flex USA LLC: www.kflexusa.com/#sle.
B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.
C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.
E. Insulation Exposed to the Weather: Finish with two coats Armstrong white Armaflex finish. Provide aluminum jacketing.

2.4 JACKETING AND ACCESSORIES

A. PVC Plastic.
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil, 0.010 inch.
e. Connections: Brush on welding adhesive.
B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.
C. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Pipe saddle.
D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.
E. Pipe Exposed in Mechanical Closets or Finished Spaces: Finish with PVC jacket and fitting covers.
F. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.3 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:
      a. Glass FIber Insulation:
         1) Pipe Size Range: 1 inches and smaller.
            (a) Thickness: 1-1/2 inch.
         2) Pipe Size Range: 1-1/2 inches and larger.
            (a) Thickness: 2 inch.
B. Cooling Systems:
   1. Chilled Water:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: 1 inches and smaller.
            (a) Thickness: 1 inch.
         2) Pipe Size Range: 1-1/2" and larger.
            (a) Thickness: 1-1/2 inch.
   2. Refrigerant Suction:
      a. Flexible Elastic Cellular Insulation:
         1) Pipe Size Range: 3/4 inch and smaller.
            (a) Thickness: 1 inch.
         2) Pipe Size Range: 1 inch and larger.
            (a) Thickness: 1.5 inch.
   3. Refrigerant Hot Gas:
      a. Flexible Elastic Cellular Insulation:
         1) Pipe Size Range: 3/4 inch and smaller.
            (a) Thickness: 1 inch.
         2) Pipe Size Range: 1 inch and larger.
            (a) Thickness: 1.5 inch.

END OF SECTION

SECTION 23 08 00

MECHANICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process relative to division 23.
B. The commissioning process is primarily the responsibility of the Commissioning Authority, with support for start-up, testing, and commissioning the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process or diminish the role and obligations to complete all portions of work in a satisfactory and fully operational manner.
C. Work of Division 23 includes:
    1. Testing and start-up of the mechanical equipment.
    2. Assistance in functional testing to verify equipment/ system performance.
    3. Providing qualified personnel to assist in commissioning tests, including seasonal testing.
    4. Completion and endorsement of pre-functional test checklists provided by the Commissioning Authority to assure that Division 23 equipment and systems are fully operational and ready for functional testing.
    5. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
    6. Providing training for the systems specified in Division 23 with coordination of owner.

1.2 RELATED WORK

A. All testing and start-up procedures and documentation requirements specified within Division 23.
B. Section 01 9100 – General Commissioning Requirements
C. Section 26 0800 – Electrical Commissioning Requirements
D. Section 22 08 00 - Plumbing Commissioning Requirements
E. Commissioning functional test procedures that require participation of the Contractors.
F. Cooperate with the Commissioning Authority in the following manner:
    1. Allow sufficient time before final completion dates so that test and balance and commissioning testing can be accomplished.
    2. Provide labor and material to make corrections when required without undue delay.
    3. Put all heating, ventilating, and air conditioning systems and equipment into full operation and continue the operation of the same during each working day of commissioning.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Standard certified test equipment for commissioning shall be provided by the TAB Contractor.
B. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so the system can be started, tested, balanced, and otherwise commissioned. Division 23 has primary start-up responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
B. The Commissioning Authority will develop a Commissioning Plan. Upon request of the Commissioning Authority, the Contractor shall provide assistance and consultation. The Commissioning Plan will be developed prior to completion of the installation. The Contractor is obligated to assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation.
C. Specific pre-commissioning responsibilities of Division 23 are as follows:
    1. Normal start-up services required to bring each system into a fully operational state. This includes motor rotational check, cleaning, filling, purging, control sequences of operation, leak testing, full-load and part-load performance, etc. The Commissioning Authority will not begin the commissioning process until each system is complete and documented, including normal contractor start-up.
    2. The Contractor shall perform pre-functional tests on the equipment and systems as noted in section 01 9100 General Commissioning Requirements.
    3. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Authority.
    4. Pre-functional test forms will be kept in the Contractors job trailer in a Commissioning Field Notebook provided by the Commissioning Authority.
    5. Factory start-up services will be provided for key equipment and systems specified in Division 23. The Contractor shall coordinate this work with the manufacturer and the Commissioning Authority.
    6. Functional testing is intended to begin upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is in the best interests of the Owner. Commissioning activities and schedule will be coordinated with the Contractor. Start of commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.
D. The Field Commissioning Notebook will be used to identify and track all pertinent commissioning documentation required during the Installation phase. This Notebook will be assembled by the Commissioning Authority and maintained by the Contractor.

The Notebook provides a central location for the Commissioning Authority to identify, copy and organize all pertinent information and will include the following format:

1. Summary describing Notebook contents and use.
2. Copy of Commissioning Plan for contractor field reference.
3. Listing of all specification documentation requirements listed by specification section, with sign off spots for appropriate contractors.
4. Tabs for each specification section with copies of pre-functional test check sheets provided by coordination of subcontractors and Commissioning Authority for contractor completion and space for related contractor-supplied documents.
5. Prior to functional testing the Commissioning Authority will use this book to verify that all appropriate contractors have completed their work and signed off that they have done so. Once the Commissioning Authority is satisfied that all components of a system are complete functional testing will begin.

3.2 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start up and debug all systems within the division of work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

3.3 WORK TO RESOLVE DEFICIENCIES

A. Maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet the original design intent. Correction of work will be completed under the direction of the Architect, with input from the Contractor, equipment supplier, and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect/Engineer of Record will have final jurisdiction on the necessary work to be done to achieve performance and or design intent.

3.4 ADDITIONAL COMMISSIONING

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their standard contractual obligations.

3.5 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.

B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.

C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.6 TRAINING

A. The Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each mechanical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.

B. Training will be conducted jointly with the equipment vendors, the Contractor and Owner’s operations and maintenance representatives. The Contractor will be responsible for the generic training, as well as instructing the Owner's staff on the system peculiarities specific to this project.

3.7 SYSTEMS DOCUMENTATION

A. Contract Documents to incorporate field changes and revisions to system designs to account for actual constructed configurations will be addressed as required in Division 1. All drawings should be red-lined on two sets. Division 23 as-built drawings should include updated architectural floor plans, and the individual mechanical systems in relation to actual building layout.

1. Maintain as-built red-lines on the job site as required in Division 1.
2. In addition to the stated requirements for operation and maintenance data, provide one copy of equipment technical literature, operation and maintenance literature, and shop drawings to the Commissioning Authority as soon as they are available. This requirement is for review of these documents prior to distribution of multiple copies for the Owner's final use.

END OF SECTION

SECTION 23 09 24

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System description.
B. Operator interface.
C. Controllers.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Division 16 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
B. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01300 - Submittals, for submittal procedures.
B. See Section 01 30 00 - Administrative Requirements for submittal procedures.
C. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.
D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
    1. Revise shop drawings to reflect actual installation and operating sequences.
E. Operation and Maintenance Data:
    1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
    2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
    3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.6 WARRANTY

A. See Section 01700 - Contract Closeout, for additional warranty requirements.
B. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
C. Provide 5 year manufacturer's warranty for system equipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Pelican Wireless.

2.2 SYSTEM DESCRIPTION

A. The Energy Management System (EMS) shall consist of thermostats, gateways and related accessories as indicated below and all related programming for a complete and fully operational web based management system using a cloud server program complying with the following specifications.
B. The entire Energy Management Solution (EMS) shall include a network of commercial Internet programmable thermostats which use IEEE 802.15.4 mesh wireless communication protocol to reach a Wireless Gateway (WG). The WG must connect to the owner’s wide area network (WAN) over a TCP/IP connection. Access and control of EMS is through a web based management tool which sits on a cloud server and must be accessible either locally or remotely via the Internet.

2.3 OPERATOR INTERFACE

A. The Web Based App (WBA) shall be able to run on any PC that uses Safari, Chrome, Firefox, or any other web browser that meets these browsers’ functionality.
B. The WBA Platform shall be able to run on any Internet Accessible Smartphone and/or Tablet that has a Web Browser compatible with HTML5.
C. The WBA shall not require any on-site servers or software to run to be usable by client.
D. The WBA shall allow up to a minimum of 100 simultaneous users/clients to access the Energy Management System.
E. The Web Based client shall support at a minimum, the following functions:
    1. User log-on identification and password shall be required.
    2. HTML programming shall not be required to display any graphics or data on theWeb page.
    3. Storage of data shall reside on cloud server and shall not sit within the client’s computer or device. EMS that requires data storage on a client computer or on-site server is not acceptable.
    4. Users shall have administrator and user definable access privileges.
    5. OpenAPI interface with XML data output.
F. Schedules:
    1. The WBA shall provide user with access to setting Internet Programmable Thermostat (IPT) schedules. Up to 12 schedule periods per day shall be available for each IPT.

2. Schedules shall be available as Weekly (7-day), Daily, or Weekday/Weekend (5-2).
3. The WBA shall provide the user the ability to:
   a. View Schedules.
   b. Add/Modify Schedules.
   c. Assign Thermostat to a Group Schedule. d. Delete Schedules.
   d. Create Share Schedules
   e. Create Event Based Schedules

G. Trending
1. The WBA shall provide real-time trend information on:
   a. Each space temperature.
   b. Each temperature set points.
   c. Each current call; heat, cool, and/or fan.
   d. Each call for economization
   e. Each damper position
2. The WBA shall be able to record and provide at least two years of past trend data for every thermostat in the wireless network. Trend data shall include:
   a. space temperature; with resolution of every 1/10th of a degree Fahrenheit.
   b. IPT's temperature set points.
   c. c. indication of whether the thermostat was calling for; heat, cool, and/or fan.
3. Trend data shall be viewable on the WBS
4. Alarm Notifications
   a. The WBA shall provide automatic alarming functionally based on real-time monitoring of at least:
      1) space temperature and temperature change.
      2) IPT's temperature set points.
      3) IPT's current call; heat, cool, and/or fan.
   b. The WBA shall be able to provide a user with the ability to:
      1) View Alarms.
      2) Set Alarm Notification sensitivity level to High, Medium, or Low. c. Delete Alarms.
   c. Alarms shall be able to be sent via email and/or text message to up to 100 or more clients.

H. Consumption Usage
1. The WBA shall be able to calculate and graphically display the consumption of running a single zone HVAC unit based on a user defined HVAC unit heat and/or cool consumption rate multiplied by the thermostat heat/cool call time.
2. The WBA shall be able to calculate and graphically display the cost of consumption of running a single zone HVAC unit based on taking a user defined HVAC unit heat and/or cool consumption and multiplying that by the client defined cost per kw and/or therm.
3. The WBA shall be able to display consumption usage for a single thermostat, multiple thermostats at a single time, or all the thermostats in the EMS.
4. The WBA shall be able to record and display up to at least two years of consumption usage information.

2.4 CONTROLLERS

A. WIRELESS GATEWAY (WG)
   1. A single WG shall be capable of providing communication between a dedicated cloud server using TCP/IP and the on-site Internet Programmable Thermostats using the IEEE 802.15.4 wireless communication protocol. Additional WGs can be used for a single site, but each WG must meet or exceed these requirements.
   2. The WG must provide the following hardware features as a minimum:
      a. Single Ethernet Port.
      b. One micro-USB 5VDC power input.
      c. 2.4 GHz IEEE std. 802.15.4 built-in communication processor.
   3. The WG shall provide the communication link between the entire system and a cloud based server. Communication with cloud server shall be secured using AES (Advanced Encryption Standard).
   4. The WG shall be able to support 2000 Internet Programmable Thermostats.

B. INTERNET PROGRAMMABLE THERMOSTAT (IPT)
   1. Internet Programmable Thermostat shall be a wireless communicating commercial programmable thermostat that uses IEEE 802.15.4 for networking communication and a wiring terminal block for controlling a single zone HVAC unit.
   2. The IPT shall provide a keypad for setting:
      a. Temperature Set points.
      b. System Mode (Heat, Cool, Auto, Off).
      c. Fan Mode (Auto, On).
      d. Light Button.
   3. The IPT shall include a wiring terminal for controlling a single zone HVAC unit or a single zone damper actuator. The wiring terminal must be able to be removed from the IPT for installations where only 3-wires exist or are available between where the IPT will be placed and its connection with the equipment it will be controlling. The thermostat must be able to control the HVAC unit based on these specifications.
   4. The IPT must be configurable using a Web Based App. No thermostat configuration, other than setting the IPT to Conventional, Heat Pump - O, or Heat Pump -B, shall be done at the thermostat. Web based Configuration Setting options shall include:
      a. Naming the thermostat
      b. Grouping multiple thermostats.
      c. System Type: Heat Pump, Conventional, or Damper Actuator system setting.
      d. If Heat Pump; reversing valve O or B setting.
      e. Cycles Per Hour (1 - 6).
      f. Anticipation Degrees (0?F - 0.5?F)
      g. Calibration Degrees (2.0?F - -2.0?F)
      h. Heat Stages (0 - 2)
      i. If Heat Pump; Aux Heat (Disabled and/or Enabled Option)
      j. Cool Stages (0 - 2)
      k. Fan Stages (1 - 2)
      l. Fan Circulation Minutes Per Hour.

m. Temperature Display (Fahrenheit or Celsius)
n. Heat Range Temperature Setting Limitation
o. Cool Range Temperature Setting Limitation
p. Ability to disable and enable Keypad Control through schedule.
q. Heat consumption (kw, btu, ton, or watt)
r. Damper Type: Open/Close or Floating
s. Reheat Type: Open/Close or Floating
t. Cool consumption (kw, btu, ton, or watt)
u. Notification Sensitivity (High, Medium, Low)
v. Alarm of exceeding temperature based on a Safe Range
w. Schedule set times (2, 3, 4, or Variable).

5. IPT settings and control through the Web Base App shall be in real-time and include:
   a. Space Temperature
   b. System Mode (Heat, Cool, Auto, Off).
   c. Fan Mode (Auto, On).
   d. Current set point.
   e. Relay status (Heat/Cool and Fan).
   f. Historical Trend Graphs.
   g. Scheduling
   h. Lock and Unlock Entire Thermostat's Keypad
   i. Lock and Unlock the Thermostat's Fan Mode setting Only

C. Internet Enabled Economizer (IEE)
   1. The IEE must be California Title 24 compliant economization control.
   2. IEE shall use up to three 10K Type II external thermistor temperature sensor input.
   3. Web Based App shall be able to record and provide at least two years of past data for IEE. Data must represent historical representations of:
      a. Calls for Economization
      b. Outside Air Damper Position
      c. Supply and Outside Air Temperature
   4. The trend data shall be viewable on the WBA.
   5. IEE must be able to send California Title 24 Fault and Diagnostics codes to the WBA, email addresses, and or text messages.
   6. IEE must have a settable 0-10VDC output for Outside Air Damper Actuator control.
   7. IEE must have a 0-10VDC input for Outside Air Damper Position Feedback.

D. Internet Enabled Air Handler Controller (IEAHC)
   1. The IEACH shall be able to wirelessly communicate with all Internet Programmable Thermostat (ITS) which are controlling a damper actuator that the IEACH is going to provide conditioned air too.
   2. ITS that meet the above statement must send IEACH information on what type of conditioned air the zone requires and how much of this conditioned air will be required to properly condition the zone.
   3. IEACH must be able to accept information from ITS and automatically calculate a supply air temperature target based on ITS demand.

4. IEACH must not run air conditioning when there is no air conditioning demand by an ITS.
5. IEACH must not run the air conditioning when there is reheat demand from an ITS.
6. IEACH must be able to provide Demand Control Ventilation if an ITS has a CO2 sensor.
7. No wire must be required between the IEACH and a zone damper or zone thermostat/sensor.
8. The IEACH must be configurable using a Web Based App. No configuration, shall be done at the IEACH. Web based Configuration Setting options shall include:
    a. 1. Name of the IEACH location
    b. 2. Description of what the IEACH is controlling
    c. 3. System Type: Heat Pump or Conventional
    d. 4. Heat stages: 1 - 3
    e. 5. Cool stages: 1 - 3
    f. 6. Fan Stages: 1, 2, or Variable
    g. 7. Variable Speed Fan: Minimum Fan Speed
    h. 8. Bypass Controller: Open damper position (VDC), Closed damper position (VDC)
    i. 9. Static Pressure:
        1) Target Operating Static: Static during a heating or cooling cycle
        2) Target Circulation Static: Static during a ventilation cycle
        3) Minimum Static: Low static safety for automatic reset
        4) Maximum Static: High static safety for automatic reset
    j. 10. Input Sensor: Supply Air Temperature
    k. 11. Input Sensor: Return Air Temperature
    l. 12. Input Sensor: Outside Air Temperature

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

3.2 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
B. Provide conduit and electrical wiring in accordance with Division 16. Electrical material and installation shall be in accordance with appropriate requirements of Division 16.

3.3 **SYSTEM PROGRAMMING**

A. The Contractor shall provide all labor necessary to install, initialize, start- up and debug all system software as described in this section. This includes any operating system software.

B. Contractor shall work with owner's representative to determine programming parameters including but not limited to hours of operation, set points, system variables, thermostat naming, and site naming. Thermostat & Site naming shall be performed by the contractor. Naming convention (equipment # or name, or space served) shall be provided by or agreed upon with the Owner.

3.4 COMMISSIONING AND STARTUP

A. EMS device functional testing.
   1. Each system for which a EMS device has been installed shall be tested for proper installation and functional operation. Test shall include on-site control test to verify each wireless device is responding to signals sent from cloud based servers and responding in accordance with manufacture's specifications.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.
B. Valves.
C. Flexible connections.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 23 07 19 - HVAC Piping Insulation.

1.3 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers; 2005.
B. AHRI 710 (I-P) - Performance Rating of Liquid-Line Driers; 2009.
C. AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers; 2013 (Reapproved 2014).
D. AHRI 760 (I-P) - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants; 2014.
E. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).
F. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2022, with Errata (2024).
G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025.
H. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
I. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.
J. ASME B31.9 - Building Services Piping; 2020.
K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
L. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.
M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
N. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
O. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

Q. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.
R. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
S. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.
C. Design Data: Submit design data indicating pipe sizing. Indicate load-carrying capacity of trapeze, multiple pipe, and riser support hangers.
D. Test Reports: Indicate results of leak test, acid test.
E. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.
B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure integrity of system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
C. Valves:
    1. Use service valves on suction and discharge of compressors.
D. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

2.2 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.
B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.
D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.3 PIPING

A. Copper Tube: ASTM B 280, H58 hard drawn, sealed ends.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
B. Pipe Supports and Anchors:
   1. Conform to ASME B31.5.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Vertical Support: Steel riser clamp.
   7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   9. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   10. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Henry Technologies: www.henrytech.com/#sle.
   3. Flomatic Valves: www.flomatic.com/#sle.
B. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

2.5 FLEXIBLE CONNECTORS

A. Manufacturers:
   1. Circuit Hydraulics, Ltd: www.circuit-hydraulics.co.uk/#sle.
   2. Flexicraft Industries: www.flexicraft.com/#sle.
   3. Penflex: www.penflex.com/#sle.
B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain-end ferrous pipe.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.
B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
C. Install piping to conserve building space and avoid interference with use of space.
D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
F. Pipe Hangers and Supports:
    1. Install in accordance with ASME B31.5.
    2. Steel hanger rods and clevis shall be cadmium or zinc plated.
    3. Support horizontal piping as indicated.
    4. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
    5. Place hangers within 12 inches of each horizontal elbow.
    6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
    7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
    8. Provide copper plated hangers and supports for copper piping.
G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
H. Provide clearance for installation of insulation and access to valves and fittings.
I. Provide access to concealed valves and fittings.
J. Flood piping system with nitrogen when brazing.
K. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
L. Insulate piping.
M. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
N. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.
O. Fully charge completed system with refrigerant after testing.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

3.4 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 3/8 inch.
2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 3/8 inch.
3. 1-3/8 inch OD: Maximum span, 6 feet; minimum rod size, 3/8 inch.
4. 1-5/8 inch OD: Maximum span, 6 feet; minimum rod size, 3/8 inch.
5. 2-1/8 inch OD: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 2-5/8 inch OD: Maximum span, 10 feet; minimum rod size, 3/8 inch.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ducts.
B. Flexible ducts.
C. Air plenums and casings.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 230713 - Duct Insulation.
C. Section 23 33 00 - Air Duct Accessories.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 126 - Method of Testing HVAC Air Ducts; 2020.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
F. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.
G. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2020.
H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
J. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids; 2020.
K. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
M. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.
N. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.
O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
C. The requirements of this Section apply to all Work of Division 23.

1.5 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide data for duct materials.
C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all ductwork systems. Provide 1/4"=1'-0" ductwork layout plans showing duct routing, offsets, fittings, duct accessories, fire/smoke dampers, hydronic piping, seismic bracing, etc. Shop drawings shall by fully coordinated with all other trades, including the building structure, finishes, fire sprinkler piping, plumbing piping, hydronic piping and electrical systems.
D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.7 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A, NFPA 90B, and SMACNA (DCS) guidelines unless stated otherwise.
B. Ductwork to be galvanized steel unless otherwise indicated.
C. Duct Sealing and Leakage in accordance with Static Pressure Class:
    1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
        a. Supply Air: 2 in-wc pressure class, galvanized steel.
        b. Outside Air Intake: 1/2 in-wc pressure class, galvanized steel.

c. Return and Relief Air: 1 in-wc 2 in-wc pressure class, galvanized steel.
d. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.

2. Low Pressure Service: Up to 2 in-wc:
   a. Seal: Class C, apply to seal off transverse joints.
3. Low Pressure Service: From 2 in-wc to 3 in-wc:
   a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
4. Medium and High Pressure Service: Above 3 in-wc:
   a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.

D. Duct Fabrication Requirements:
1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
6. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.
7. Exposed ductwork within occupied spaces shall be 20 gauge minimum.

2.2 METAL DUCTS

A. Material Requirements:
1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
2. Stainless Steel: ASTM A666, Type 304.
   a. Application: Kitchen exhaust.

B. Round Spiral Duct:
1. Round spiral lock seam duct with galvanized steel outer wall.
2. Manufacturers:
   a. EHG, a DMI Company: www.ehgduct.com/#sle.
   b. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   c. Linx Industries, Inc, a DMI Company: www.li-hvac.com/#sle.
   d. MKT Metal Manufacturing: www.mktduct.com/#sle.

C. Connectors, Fittings, Sealants, and Miscellaneous:
1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
   a. Manufacturers:

1) Carlisle HVAC Products: www.carlislehvac.com/#sle.
2) Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
3) Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.

3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   b. VOC Content: Not more than 250 g/L, excluding water.
   c. Sealants intended for use outdoors to include UV inhibitors.
   d. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   e. Manufacturers:
      1) Carlisle HVAC Products; Hardcast Duct-Seal 321 Indoor/Outdoor Water Based Duct Sealant: www.carlislehvac.com/#sle.
      2) Design Polymerics; DP 1010 Water Based Smooth Duct Sealant, Premium Quality: www.designpoly.com/#sle.
      3) Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
4. Gasket Tape:
   a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
   b. Manufacturers:
      1) Design Polymerics; DP 1040 100 Percent Solids, High Pressure/High-Velocity Butyl Gasket Tape: www.designpoly.com/#sle.
      2) Elgen Manufacturing Company, Inc; 440 Butyl Gasket Tape: www.elgenmfg.com/#sle.

2.3 FLEXIBLE DUCTS

A. Flexible Air Ducts:
   1. UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound spring steel wire.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: From 4 in-wc positive to 0.5 in-wc negative.
   4. Maximum Velocity: 4,000 fpm.
   5. Temperature Range: Minus 20 to 210 degrees F.
   6. Manufacturers:
      a. JP Lamborn Co: www.jplflex.com/#sle.
      b. Atco Rubber Products, Inc..

2.4 AIR PLENUMS AND CASINGS

A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.
B. Minimum Fabrication Requirements:
   1. Fabricate acoustic plenum or casing with reinforcing turned inward.

2. Provide 16-gauge, 0.059-inch sheet steel back facing and 22-gauge, 0.029-inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers.
3. Construct panels 1 inches thick, packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch sheet steel.

C. Access Doors:
1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.

2.5 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

A. Provide ductwork, fittings, and appurtenances in accordance with NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.
B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.
C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.
D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.
E. Dishwasher Exhaust Duct:
1. Duct Size: 1 in-wc pressure class stainless steel.
2. Fabricate using single wall, 16-gauge, 0.059-inch sheet steel with continuous external welded joints to form rectangular sections.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).
B. Install products following the manufacturer's instructions.
C. Comply with safety standards NFPA 90A and NFPA 90B.
D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
F. Ductwork exposed to view outdoors shall be primed and painted, color by architect.
G. Flexible Ducts: Connect to metal ducts with adhesive plus sheet metal screws.
H. Flexible Ducts: Maximum length of single runout to air inlet or outlet to be 5 feet per CMC.
I. Duct sizes indicated are outside dimensions. For lined ducts, duct sizes must be increased to account for lining.
J. Seal all standing seams and transverse joints in all sheetmetal ductwork with Hardcast DT tape, 4 inches wide, and Hardcast FTA-20 adhesive.
K. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
L. Use double nuts and lock washers on threaded rod supports.

M. Connect diffusers boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices.
B. Backdraft dampers - metal.
C. Combination fire and smoke dampers.
D. Duct access doors.
E. Duct test holes.
F. Fire dampers.
G. Flexible duct connectors.
H. Volume control dampers.
I. Miscellaneous Products:
    1. Damper operators.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 23 31 00 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
D. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
G. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
H. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
I. UL 555C - Standard for Safety Ceiling Dampers; Current Edition, Including All Revisions.
J. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.
K. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

1.4 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
C. The requirements of this Section apply to all Work of Division 23.

1.5 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

1.6 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors and test holes.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES

A. Manufacturers:
1. ProRail, Ductmate Industries, Inc.
2. Duro Dyne Corp.
B. Manufactured turning vanes with 2" single thickness curved blades set at 1-1/2" on-center mounted in 2" vane rails, self-aligning, hot dipped galvanized steel.
C. Turning vanes, vane rails and mounting shall be constructed and installed in accordance with the SMACNA "HVAC Duct Construction Standards".

2.2 BACKDRAFT DAMPERS - METAL

A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Pottorff: www.pottorff.com/#sle.
   2. Ruskin Company: www.ruskin.com/#sle.
B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
C. Provide factory sleeve and collar for each damper.
D. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
E. Operators: UL listed and labelled oil immersed with spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft. Provide circuitry to activate pilot light on remote key (test) switch located in corridor ceiling adjacent to damper.
F. All actuators for combination fire and smoke dampers or smoke dampers shall be rated for continuous "On" duty and shall have a cycle time requirement of no more frequently than every six months.

2.4 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   2. Ruskin Company: www.ruskin.com/#sle.
   3. or equal.
B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch thick insulation with sheet metal cover.
   1. High Temperature Duct Access Doors:
      a. Comply with NFPA 96.
      b. Comply with UL 1978.
C. Access doors with sheet metal screw fasteners are not acceptable.

2.5 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.6 FIRE DAMPERS

A. Manufacturers:
   1. Pottorff: www.pottorff.com/#sle.
   2. Ruskin Company: www.ruskin.com/#sle.
B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
C. Ceiling (Radiation) Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame and 16-gauge, 0.0598-inch flap, two layers of 0.125-inch thick ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
   1. Rated for three hour service in compliance with UL 555C.

D. Horizontal Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame, stainless steel closure spring, and lightweight, heat-retardant, non-asbestos fabric blanket.
E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1-inch pressure-class ducts up to 12 inches in height.
F. Multiple Blade Dampers: 16-gauge, 0.0598-inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.7 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
1. Carlisle HVAC Products: www.carlislehvac.com/#sle.
2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
B. Fabricate in accordance with SMACNA (DCS) and as indicated.
C. Flexible Duct Connections (Indoors): Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.
D. Flexible Duct Connections (Outdoors): Fabric crimped into metal edging strip.
1. Fabric: Ventfabrics Ventlon UL listed fire-retardant duPont's Hypalon coated woven glass fiber fabric to NFPA 90A, minimum density 26 oz per sq yd, sunlight, ozone and weather resistant.
a. Net Fabric Width: Approximately 3 inches wide.
2. Metal: 3 inches wide, 24 gage thick galvanized steel.

2.8 VOLUME CONTROL DAMPERS

A. Manufacturers:
1. Nailor Industries, Inc: www.nailor.com/#sle.
2. Ruskin Company: www.ruskin.com/#sle.
3. United Enertech: www.unitedenertech.com/#sle.
B. Fabricate in accordance with SMACNA (DCS) and as indicated.
C. Single Blade Dampers for Round Ductwork and Rectangular Ductwork up to 10 inches in Height: 18 gauge steel minimum.
D. Multi-Blade Damper for Rectangular Ductwork: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware; Model CD35 Manufactured by Ruskin. Provide Ruskin Model CD50 for installation in medium pressure ductwork and/or ducts with velocities exceeding 1500 FPM.
E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings, Ventlok Model 607. On multiple blade dampers, provide oil impregnated nylon or sintered bronze bearings.
F. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.9 MISCELLANEOUS PRODUCTS

A. Remote Balancing Damper Operator: Cable operated remote damper controller.
   1. Manufacturers:
      a. Young Regulator Co.; www.youngregulator.com
   2. "Bowden" damper regulator with mounting bracket, hub and cable coupling.
   3. "Bowden" stainless steel operating cable and control wrench. Cable to be 50 foot length standard.
   4. Recessed control box with control shaft, cable coupling and cover plate.
   5. Provide options and accessories as needed for balancing damper.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.
B. Coordinate fire/smoke damper requirements with Division 26 and Division 28.
C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 14 by 14 inch size access door for hand and shoulder access, or as indicated on drawings.
D. For concealed balancing dampers only where damper is inaccessible, provide Young Regulator "Bowden" cable operated damper controller.
E. Provide duct test holes where indicated and required for testing and balancing purposes.
F. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
G. Install combination smoke and fire dampers in accordance with NFPA 92A.
H. Demonstrate re-setting of fire dampers to Owner's representative.
I. Provide balancing dampers at points on supply, return, outside air and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.
B. Ceiling exhaust fans.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
B. Section 23 31 00 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
B. AMCA 99 - Standards Handbook; 2016.
C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.
D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).
E. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance; 2022, with Editorial Revision (2023).
F. AMCA 260 - Laboratory Methods of Testing Induced Flow Fans for Rating; 2020.
G. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.
H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.
I. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance; 2016.
J. ANSI Z9.5 - Laboratory Ventilation; 2022.
K. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids; 2020.
L. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
M. UL 705 - Power Ventilators; Current Edition, Including All Revisions.
N. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.4 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
C. The requirements of this Section apply to all Work of Division 23.

1.5 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.
C. Manufacturer's Instructions: Indicate installation instructions.
D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Protect units from physical damage by storing indoors or off site until roof mounting curbs or other mountings are in place, ready for immediate installation of units.

1.8 WARRANTY

A. See Division 1 for additional warranty requirements.
B. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Greenheck Fan Corporation: www.greenheck.com/#sle.
B. Loren Cook Company: www.lorencook.com/#sle.

2.2 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: Comply with AMCA 204.
B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.
C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
D. Fabrication: Comply with AMCA 99.
E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.
F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.3 ROOF EXHAUSTERS

A. Product Requirements:
   1. Performance Ratings: Conform to AMCA 210 and bearing the AMCA Certified Rating Seal.
   2. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
   3. Fabrication: Conform to AMCA 99.
   4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Roof exhaust fans fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength.

D. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.

E. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.

F. A fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.

G. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

H. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

I. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, and insulation.

J. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

K. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

L. See drawing schedule for additional optional equipment requirements.

2.4 CEILING EXHAUST FANS

A. The fan wheel shall be of the galvanized steel, forward curved, centrifugal type. Wheels shall be dynamically and statically balanced.

B. Motors shall be of the heavy duty type with permanently sealed ball bearings. The wheel shaft shall be ground and polished steel mounted in permanently sealed pillow block bearings. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulleys shall be adjustable for final system balancing.

C. All fans shall bear the AMCA Certified Ratings Seal for air performance.

D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
E. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing , resilient mounted motor.
F. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor and wall mounted switch.
G. Grille: Aluminum with baked white enamel finish.
H. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Secure roof exhausters with stainless steel lag screws to roof curb. See drawings for additional mounting requirements.
C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
D. Provide sheaves required for final air balance.
E. Provide speed control on direct drive fans required for final air balance.
F. Install backdraft dampers on inlet to roof exhausters.
G. Provide backdraft dampers on outlet from cabinet and ceiling exhaust fans and as indicated.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers
B. Registers/grilles
C. Door grilles.
D. Louvers:
E. Gravity ventilators.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.3 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).
B. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; Air Diffusion Council; 1984.
C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.
D. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).
E. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2022.
F. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.
G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
L. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.
M. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.4 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
C. The requirements of this Section apply to all Work of Division 23.

1.5 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
C. Project Record Documents: Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
B. Test and rate louver performance in accordance with AMCA 500-L.
C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Krueger-HVAC: www.krueger-hvac.com/#sle.
B. Price Industries: www.price-hvac.com/#sle.
C. Ruskin Company: www.ruskin.com/#sle.
D. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.
E. Tuttle and Bailey: www.tuttleandbailey.com/#sle.

2.2 **DIFFUSERS**

A. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
B. Fabrication: Steel or aluminum with baked enamel finish.
C. Color by Architect.
D. Accessories: Provide radial opposed blade, butterfly, combination splitter, and volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.
E. SEE DRAWINGS FOR DIFFUSER SPECIFICATIONS.

2.3 **REGISTERS/GRILLES**

A. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
B. Fabrication: Steel or aluminum with baked enamel finish.
C. Color by Architect.
D. Accessories: Provide radial opposed blade, butterfly, combination splitter, and volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing

grid, operating rod extension, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.

E. SEE DRAWINGS FOR REGISTER/GRILLE SPECIFICATIONS.

2.4 DOOR GRILLES

A. Type: V-shaped louvers of 20 gauge, 0.0359 inch thick steel, 1 inch deep on 1/2 inch centers.
B. Frame: 20 gauge, 0.0359 inch steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.5 COMBINATION LOUVERS

A. Damper-combined, drainable louver:
B. Size: As indicated on the drawings.
C. Material: Extruded aluminum.
D. Paint Finish and Color: To be selected by Architect from manufacturer's full range.
E. Sleeve or Flange: Factory-mounted standard.
F. Linkage: Concealed in frame.

2.6 GRAVITY VENTILATORS

A. Hood Intake and Relief Gravity Ventilator:
    1. Manufacturers:
        a. Greenheck Fan Corporation: www.greenheck.com/#sle.
        b. Loren Cook Company: www.lorencook.com/#sle.
    2. General:
        a. Low silhouette for intake and relief applications with natural gravity or negative pressure system(s).
        b. Performance ratings and factory testing in accordance with AMCA 511 and AMCA 550.
        c. Suitable for non-ducted applications.
        d. Equipment to bear permanently affixed manufacturer's nameplate listing model and serial number.
    3. Hood and Base:
        a. Material: Aluminum.
        b. Hood Construction: Precision formed, arched panels with interlocking seams.
        c. Vertical End Panels: Fully locked into hood end panels.
    4. Birdscreen:
        a. Fabricate in accordance with ASTM B221 (ASTM B221M).
        b. Construction: 1/2 inch Galvanized mesh.
        c. Horizontally mounted across hood intake area.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
D. Install diffusers to ductwork with air tight connection.
E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.
F. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION

SECTION 23 72 23
PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 2 PRODUCTS

1.1 ENERGY RECOVERY UNITS

1.1.SUMMARY

A. This section includes Energy Wheel Air-to-Air Energy Recovery Ventilators for rooftop installation.

B. Related Sections include the following:

1. Section 22 00 00: Scope of Work
2. Section 22 01 00: General Provisions
3. Section 22 07 00: Insulation
4. Section 22 10 00: Plumbing
5. Section 23 09 00: Controls and Instrumentation
6. Section 23 00 00: Electrical

1.2.SUBMITTALS

A. Product Data: For each type or model include the following:

1. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
2. Energy wheel performance data for both summer and winter operation.
3. Motor ratings, electrical characteristics and motor and fan accessories.
4. Combined efficiency data per ARI Guideline V-2003 for each model. Data shall include RER, COP, Unitary Net Cooling, Unitary EER and CEF.
5. Material types and gauges of all component pieces and assemblies.
6. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
7. Estimated gross weight of each installed unit.
8. Installation, Operating and Maintenance manual (IOM) for each model.

1.3.QUALITY ASSURANCE

A. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.

B. For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.

C. Product Options: Drawings must indicate size, profiles and dimensional requirements of Energy Recovery Units and are to be based on the specific system indicated. Refer to Division 1 Section "Product Requirements".

D. Certifications

1. Energy Wheel shall be AHRI Certified, per Standard 1060.

1.4.COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.

B. Coordinate sequencing of construction of associated plumbing, HVAC, electrical supply, roofing contractor.

2. PRODUCTS

2.1.MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include:

1. Greenheck Fan Corporation

2.2.MANUFACTURED UNITS

A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, outdoor air intake weatherhood with metal mesh filters, energy wheel, motorized intake damper, motorized exhaust damper, curb assembly, frost control, filter assembly for intake and exhaust air, supply air blower assembly, exhaust air blower assembly and an electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

2.3.CABINET

A. Materials: Formed single wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.

1. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish.
2. Internal assemblies: 18 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.

B. Access doors shall be hinged.

C. Shall have factory-installed duct flanges on all duct openings.

D. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
   a. Thickness: 1 inch (25 mm)

b. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.

c. Location and application: Full coverage of entire cabinet exterior to include walls, roof and floor of unit. Insulation shall be of semi-rigid type and installed between inner and outer shells of all cabinet exterior components.

E. Energy wheel: Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt with a five year warranty. The wheel media shall be a polymer film matrix in a stainless steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and shall be designed and constructed to permit cleaning and servicing. The energy wheel is to have a five year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

F. Supply Air and Exhaust Air blower assemblies: Blower assemblies consist of an electric motor and a belt driven blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on 1.125 inch thick neoprene vibration isolators.

G. Control panel / connections: Energy Recovery Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.

H. Frost control: modulating wheel.

I. Modulating frost control. Control system shall include an outdoor air thermostat and pressure sensor on the wheel assembly to initiate frost control sequence.

J. Motorized dampers / Exhaust Air, Intake Air, Motorized dampers of low leakage type shall be factory installed.

K. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.

2.4.BLOWER

A. Blower section construction, Supply Air and Exhaust Air: Belt drive motor and blower shall be assembled onto a 14 gauge galvanized steel platform and must have neoprene vibration isolation devices.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.

D. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.

E. Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

2.5.MOTORS

A. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Minimum compliance with EPAct minimum energy-efficiency standards for single speed ODP and TEFC enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley. Comply with requirements in Division 23 05 13, matched with fan load.

B. Fan motors shall be 60 cycle, 3 phase 460 volts.

2.6.UNIT CONTROLS

A. The unit shall be constructed so that it can be controlled by a factory-supplied controller or it can be monitored and controlled by a Building Management System (BMS).

B. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drives for modulation of the blower motors. The VFDs shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

2.7.FILTERS

A. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 13 disposable pleated filters shall be provided in the intake air stream and MERV 8 filters in the exhaust air stream.

3. EXECUTION

3.1.EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2.INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3.CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

1. Duct installation and connection requirements are specified in Division 23 of this document.
2. Electrical installation requirements are specified in Division 26 of this document.

3.4.START-UP SERVICE

A. Engage a qualified field technician to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

END OF SECTION

SECTION 23 74 13

PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged Heat Pump Unit.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.
B. AHRI 270 (SI/I-P) - Sound Performance Rating of Outdoor Unitary Equipment; 2025.
C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
D. Unit shall be designed to conform to ASHRAE 15, latest revision, and in accordance with UL 1995.
E. Units shall be UL tested and certified in accordance with ANSI Z21.47 Standard. Units may be ETL listed.
F. New roof curbs shall be designed to conform to NRCA Standards.
G. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.7 WARRANTY

A. See Division 1 for additional warranty requirements.
B. Provide a one year warranty to include coverage for refrigeration compressors.
C. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.
D. Provide five year limited warranty for heat exchanger including materials only.
E. Furnish one complete set of fan motor drive belts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Packaged Heat Pump Units
   1. Daikin Rebel.
   2. The Carrier Corporation.
   3. JCI.
   4. No other manufacturers will be accepted.

2.2 **PACKAGED HEAT PUMP UNITS**

A. General
   1. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing hermetic scroll compres-sor(s) for cooling duty and heat pump for heating duty.
   2. Factory assembled, single piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
   3. Unit shall be installed in accordance with the manufacturer’s instructions.
   4. Unit must be selected and installed in compliance with local, state, and federal codes.
   5. Unit shall meet ASHRAE 90.1 and IECC minimum efficiency requirements.
   6. Unit shall be rated in accordance with AHRI Standards 210/240 and 340/360.
   7. Unit shall be designed to conform to ASHRAE 15.
   8. Unit shall be UL-tested and certified in accordance with ANSI Z21.47 Standards and UL or ETL-listed and certified under Canadian standards as a total package for safety requirements.
   9. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
   10. Unit internal insulation linings shall be resistant to mold growth in accordance with “mold growth and humidity” test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the “Erosion Test” in UL 181, as part of ASTM C1071.

11. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
12. Roof curb shall be designed to conform to NRCA Standards.
13. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.
14. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.
15. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.

B. Delivery, Storage, and Handling:
   1. Unit shall be stored and handled per manufacturer's recommendations.
   2. Unit shall only be stored or positioned in the upright position.

C. Operating Characteristics:
   1. Unit shall be capable of starting and running at 125°F (52°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at ± 10% voltage.
   2. Compressor with standard controls shall be capable of operation down to 30°F (–1°C), ambient outdoor temperatures. Accessory Low Ambient controls are available if mechanically cooling at ambient temperatures below 30°F (–1°C).
   3. Unit shall be capable of simultaneous heating duty and defrost cycle operation when using accessory electric heaters.

D. Unit Cabinet:
   1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
   2. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.
   3. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.
   4. Condensate Pan and Connections:
      a. Shall be a sloped condensate drain pan made of a non-corrosive material.
      b. Shall comply with ASHRAE Standard 62.
   5. Gas Connections:
      a. All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location.
   6. Electrical Connections:
      a. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.
   7. Component Access Panels (standard):
      a. Cabinet panels shall be easily removable for servicing.

E. Coils:

1. Standard Aluminum Fin/Copper Tube Coils:
    a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
2. Optional Pre-Coated Aluminum-Fin Condenser Coils:
    a. Shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments.
    b. Corrosion durability of fin stock shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.

F. Refrigerant components:
1. Refrigerant circuit shall include the following control, safety, and maintenance features:
    a. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.
        1) Refrigerant filter drier on each refrigerant circuit.
        2) Service gauge connections on suction and discharge lines.
        3) Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching. Standard on each refrigerant circuit.
2. Compressors:
    a. Unit shall use fully hermetic, scroll compressors.
        1) Compressor motors shall be cooled by refrigerant gas passing through motor windings.
        2) Compressors shall be internally protected from high discharge temperature conditions.
        3) Compressors shall be protected from an overtemperature and over-amperage conditions by an internal, motor overload device.
        4) Compressor shall be factory mounted on rubber grommets.
        5) Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
        6) Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.

G. Filter section:
1. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
2. Filters shall be standard, commercially available sizes.

H. Evaporator fan and motor:
1. Evaporator fan motor:
    a. Shall have permanently lubricated bearings.
        1) Shall have inherent automatic-reset thermal overload protection or circuit breaker.
        2) Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.

2. Evaporator fan:
    a. Blower fan shall be double inlet type with forward curved blades.
        1) Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

I. Condenser Fans and Motors:
1. Condenser fan motors:
    a. Shall be a totally enclosed motor.
        1) Shall use permanently lubricated bearings.
        2) Shall have inherent thermal overload protection with an automatic reset feature.
2. Condenser fans:
    a. Shall be a direct driven propeller type fan and shall be dynamically balanced.

J. Special features, options, and accessories:
1. Head pressure control package:
    a. Controller shall control coil head pressure by condenser fan speed modulation or condenser fan cycling and wind baffles.
    b. Shall consist of solid state control and condenser coil temperature sensor to maintain condensing temperature between 90°F (32°C) and 110°F (43°C) at outdoor ambient temperatures down to –20°F (–29°C).
2. Condenser Coil Hail Guard Assembly:
    a. Shall protect against damage from hail.
    b. Shall be louvered style design.
3. Economizer:
    a. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.
    b. Ultra low leak design meets California Title 24 and, ASHRAE 90.1 and IECC requirements.
    c. Shall be capable of introducing up to 100% outdoor air.
    d. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.
    e. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
    f. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
    g. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1-2016 and IECC-2015 requirements.
    h. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.
    i. Dampers shall be completely closed when the unit is in the unoccupied mode.
    j. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
    k. Combined minimum and DCV maximum damper position potentiometers with compressor staging relay.

l. On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economiz-er is not operating properly, per California Title 24.
m. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also avail-able on factory-installed only. Outdoor air sensor setpoint shall be adjustable and shall range from 40 to 100°F (4 to 38°C). Additional sensor options shall be available as accessories.

4. Propeller power exhaust:
   a. Power exhaust shall be used in conjunction with an integrated economizer.
   b. Independent modules for vertical or horizontal return configurations shall be available.
   c. Horizontal power exhaust shall be mounted in return ductwork.
   d. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0 to 100% adjustable setpoint on the economizer control.
5. Roof curbs (vertical):
   a. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
   b. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
6. Anti-short Cycle Timer:
   a. Shall prevent compressor short cycling by providing a 5-minute delay (±2 minutes) before restarting a compressor after shutdown for any reason.
   b. One device shall be required per compressor.
7. Electric Heat:
   a. Heating Section:
      1) Heater element open coil resistance wire, nickel-chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
      2) Heater assemblies are provided with integral fusing in the single point box (if applicable) for protection of internal heater circuits not exceeding 48 amps each. Electric heaters use a combination of 24v control side break/auto-reset, line-break/non-resettable “one shot” limit switches to protect the unit against over-temperature situations. All heaters use magnetic heater contactors (24 v coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.
8. Hinged Access panels:
   a. Shall provide easy access through integrated quarter turn latches.
   b. Shall be on major panels of filter, control box, fan motor and compressor.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install in accordance with NFPA 90A.
C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.3 SYSTEM STARTUP

A. Provide factory start-up and supervise installation by Contractor.

END OF SECTION

SECTION 23 81 26

SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air-source heat pumps.
B. Air cooled condensing units.
C. Indoor air handling (fan and coil) units for ducted systems.
D. Indoor air handling (fan and coil) units for ductless systems.

1.2 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.
B. AHRI 270 (SI/I-P) - Sound Performance Rating of Outdoor Unitary Equipment; 2025.
C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.
D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).
E. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.
F. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).
G. ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2022.
H. NEMA MG 00001 - Motors and Generators; 2024.
I. NFPA 54 - National Fuel Gas Code; 2024.
J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
L. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2024.
M. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.
N. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Division 1 specifications for submittal procedures.
B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 WARRANTY

A. See Division 1 for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Daikin
B. Carrier
C. Samsung
D. No other manufacturers will be accepted.

2.2 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
   2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
B. Performance Requirements: See Drawings for additional requirements.

2.3 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: horizontal and upflow.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
   2. Motor Electrical Characteristics:
C. Air Filters: 2 inch thick glass fiber disposable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

2.4 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturer: System manufacturer.

2.5 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Comply with AHRI 210/240.
   2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
   3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.
B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high-pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.
C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
D. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.
   2. Provide heat pump reversing valves.
E. Operating Controls:
   1. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
B. Verify that proper power supply is available and in correct location.
C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
B. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION

SECTION 23 81 29
VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/Condensing unit(s):
      a. Size Range: 6 to 40 Tons Nominal

1.02 RELATED REQUIREMENTS

A. N/A

1.03 REFERENCES

A. N/A

1.04 SUBMITTALS

A. N/A

1.05 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:
   1. The units shall be tested by a National Recognized Testing Laboratory (NRTL), in accordance with 60335-2-40 Heating and Cooling Equipment and bear the Listed Mark.
   2. All wiring shall be in accordance with the National Electric Code (NEC).
   3. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
   4. The condensing unit will be factory charged with R-32.

1.06 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

1.07 WARRANTY

A. STANDARD LIMITED WARRANTY
   1. Complete warranty details will be available from your local Daikin representative or at www.daikincomfort.com.
   2. Daikin North America LLC warrants original owner of the non-residential building, multifamily residence or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration starting from the ''installation date'' which is one of the two dates below:
      a. The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit's rating plate.

b. If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1. Daikin
2. Carrier
3. Samsung
4. No other manufacturers will be accepted.

2.02 HVAC SYSTEM DESIGN

A. SYSTEM DESCRIPTION:

1. The variable capacity heat recovery air conditioning system shall be a Daikin Variable Refrigerant Volume Series system as specified.
2. The system shall consist of multiple evaporators using PID control, REFNET™ joints and headers and Daikin VRV□ condenser unit.
3. The condenser shall be a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable speed inverter driven compressors using R-32 refrigerant.
4. The condensing unit may connect an indoor evaporator nominal capacity up to 200% of the condensing unit's nominal capacity. All zones can operate separately with individual temperature control.
5. The Daikin condensing unit shall be able to connect to indoor unit models FXFA, FXMA, FXSA, FXTA, FXDA, FXZA, FXUA, FXAA, and OTHER IDUs and shall range in capacity from 5,800 Btu/h to 96,000 Btu/h in accordance with Daikin’s engineering data book detailing each available indoor unit.
   a. The indoor units shall be connected to the condensing unit utilizing Daikin’s REFNET™ specified piping joints and headers to ensure correct refrigerant flow and balancing. T-style joints are not acceptable for a variable refrigerant system.
6. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.

7. The REYA_AA condensing unit model numbers and the associated number of connectable indoor units per REYA_AA condensing unit is indicated in the following table. Each indoor unit or group of indoor units shall be independently controlled.

MODEL NUMBER	NOMINAL CAPACITY (Tons)	MAXIMUM NUMBER OF INDOOR UNITS

REYA72AATJ*	6	12
REYA96AATJ*	8	16
REYA120AATJ*	10	20
REYA144AATJ*	12	25
REYA168AATJ*	14	29
REYA192AATJ*	16	33
REYA216AATJ*	18	37
REYA240AATJ*	20	41
REYA264AATJ*	22	45
REYA288AATJ*	24	49
REYA312AATJ*	26	54
REYA336AATJ*	28	58
REYA360AATJ*	30	64
REYA384AATJ*	32	64
REYA408AATJ*	34	64
REYA432AATJ*	36	64
REYA456AATJ*	38	64
REYA480AATJ*	40	64

B. *VRV EMERION* FEATURES AND BENEFITS

1. Voltage Platform - Heat Pump condensing units shall be available with a 460V/3ph/60 Hz power supply.
2. Single-module outdoor units shall be available from 6 to 20 T in nominal cooling capacity and can be combined to offer up to 40 T in a dual-module configuration, which helps minimize the overall space required for mechanical equipment and optimize total project costs.
3. The condensing unit shall feature a sealed E-box with a minimum IP55 rating to provide high dust and moisture protection for reliability.
4. Each system shall be able to enlarge from single to dual module without the need for installed main pipe size changes. The manufacturer shall provide predefined pipe sizes and design rules ensuring reliable system operation and offering design flexibility in phased installation applications.
5. Stable Operation – System shall provide stable inverter operation at varied ambient conditions.
6. No Drain Pan Heater – System shall be capable of heating operation without the need for a drain pan heater. If an alternate manufacturer is chosen, an additional drain pan heater shall be provided by the manufacturer.
7. Auto Changeover – System shall, below the field selected outdoor ambient temperature provide signal to initiate auxiliary or back up heat.
8. Advanced Zoning - A single system shall provide up to 64 zones.
9. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve with up to 2000 positions for independent control.

10. VFD Inverter Control and Smart Variable Refrigerant Temperature - Each condensing unit shall use high efficiency, variable speed all “inverter” based flash vapor injection compressor(s) coupled with inverter fan motors to optimize part load performance. The system capacity and refrigerant temperatures shall be modulated automatically to set suction and condensing pressures while varying the refrigerant volume for the needs of the cooling or heating loads. The control will be automatic and customizable depending on load and weather conditions.
    a. Indoor shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency.
11. Configurator software - Each system shall be available with configurator software package to allow for remote configuration of operational settings and for assessment of operational data and error codes.
    a. If this software is not provided by an alternate manufacturer, for each individual outdoor unit the contractor shall do the settings manually and keep detailed records for future maintenance purposes.
12. Each system shall include a built-in data recorder that can store up to 40 minutes of operational data which can help identify the issue in case of a product failure.
13. Heating during Defrost and Oil Return. Reverse cycle (cooling mode) in these modes shall not be permitted due to the potential reduction in space temperature.
14. Low Ambient Cooling - Each system shall be capable of low ambient cooling operation to -4°FDB (-20°CDB) with the use of a Safety Shut off Valve.
15. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve for independent control.
16. Flexible Design –
    a. Systems shall be capable of up to 540ft (165m) [623 ft. (190m) equivalent] of linear piping between the condensing unit and furthest located indoor unit.
    b. Systems shall be capable of up to 3,280ft (1,000m) total “one-way” piping in the piping network.
    c. Systems shall have a vertical (height) separation of up to 361 ft between the condensing unit and the indoor units.
    d. Systems shall be capable of up to 295ft (90m) from the first REFNET™ / branch point.
    e. The condensing unit shall have the ability to connect an indoor unit evaporator capacity of up to 200% of the condensing unit nominal capacity.
    f. Systems shall be capable of 98ft (30m) vertical separation between indoor units.

g. Condensing units shall be supported with a fan motor ESP up to 0.32" WG as standard to allow connection of discharge ductwork and to prevent discharge air short circuiting.

17. Oil return – Each system shall be furnished with a centrifugal oil separator and active oil recovery cycle.
18. Simple wiring – Systems shall use 16/18 AWG, 2 wire, stranded, non-shielded and non-polarized daisy chain control wiring.
19. Space saving – Each system shall not exceed the dimensions shown below

MODEL NUMBER	Dimensions in Inch (H x W x D)
REYA72AATJ*	65-3/8 x 36-5/8 x 30-1/8
REYA96AATJ*	65-3/8 x 48-13/16 x 30-1/8
REYA120AATJ*	
REYA144AATJ*	
REYA168AATJ*	
REYA192AATJ*	65-3/8 x 68-7/8 x 30-1/8
REYA216AATJ*	
REYA240AATJ*	
REYA264AATJ*	(65-3/8 x 48-13/16 x 30-1/8) + (65-3/8 x 48-13/16 x 30-1/8)
REYA288AATJ*	
REYA312AATJ*	
REYA336AATJ*	
REYA360AATJ*	(65-3/8 x 48-13/16 x 30-1/8) + (65-3/8 x 68-7/8 x 30-1/8)
REYA384AATJ*	(65-3/8 x 68-7/8 x 30-1/8) + (65-3/8 x 68-7/8 x 30-1/8)
REYA408AATJ*	
REYA432AATJ*	
REYA456AATJ*	
REYA480AATJ*	

20. Each condensing unit shall include a multi-functional digital display that can provide system operation status such as operating refrigerant temperatures, pressures, outdoor electronic expansion valve opening and compressor operation time.
21. Each condensing unit shall include a service window that can provide easy access to system field settings and operation status without completely removing the condensing unit panel.
22. Advanced diagnostics – Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.

23. Each condensing unit shall incorporate contacts for electrical demand shedding with optional 3 stage demand control with 12 customizable demand settings.
24. Advanced controls – Each system shall have at least one remote controller capable of controlling up to 16 indoor units.
25. Each system shall be capable of integrating with open protocol BACnet, LonWorks and Modbus building management systems.
26. Low sound levels - Each system shall use indoor and condensing units with quiet operation as low as 27 dB(A).
27. The system shall be certified and listed in the OSHPD directory for seismic certification.
28. The condensing unit can be installed up to 200 ft above the ground without requiring any additional field modifications to the unit to comply with the Florida Miami Dade Wind code requirements.
29. The condensing unit shall be factory equipped with a Schrader valve for connection to a pressure relief kit for compliance with the City of Chicago Pressure relief code.

PART 1
2.03 EQUIPMENT
A. PERFORMANCE:
1. The VRV REYA_AA system shall perform as indicated below:

MODEL NUMBER	SYSTEM IEER (Ducted)	SYSTEM IEER (Non-Ducted)
REYA72AATJ*	21.20	23.60
REYA96AATJ*	21.20	24.20
REYA120AATJ*	20.20	23.00
REYA144AATJ*	19.70	22.70
REYA168AATJ*	19.00	21.70
REYA192AATJ*	19.80	22.20
REYA216AATJ*	18.70	21.80
REYA240AATJ*	18.00	20.40
REYA264AATJ*	18.40	21.60
REYA288AATJ*	18.40	21.00
REYA312AATJ*	18.00	20.60
REYA336AATJ*	17.70	19.80
REYA360AATJ*	17.40	18.90
REYA384AATJ*	18.00	20.70
REYA408AATJ*	17.20	19.90
REYA432AATJ*	16.80	18.80

REYA456AATJ*	16.20	18.30
REYA480AATJ*	15.80	18.00

MODEL NUMBER	SYSTEM EER (Ducted)	SYSTEM EER (Non-Ducted)
REYA72AATJ*	12.40	12.50
REYA96AATJ*	12.00	12.20
REYA120AATJ*	11.10	11.10
REYA144AATJ*	11.00	11.20
REYA168AATJ*	10.70	10.70
REYA192AATJ*	11.30	11.40
REYA216AATJ*	11.00	10.90
REYA240AATJ*	10.70	10.70
REYA264AATJ*	10.20	11.20
REYA288AATJ*	10.40	11.40
REYA312AATJ*	10.20	10.90
REYA336AATJ*	10.00	9.80
REYA360AATJ*	9.70	10.50
REYA384AATJ*	9.90	10.50
REYA408AATJ*	9.70	10.00
REYA432AATJ*	9.30	9.80
REYA456AATJ*	9.00	9.40
REYA480AATJ*	9.00	8.90

MODEL NUMBER	SYSTEM COP@47°F (Ducted)	SYSTEM COP@47°F (Non-Ducted)
REYA72AATJ*	3.60	3.80
REYA96AATJ*	3.60	3.80
REYA120AATJ*	3.50	3.50
REYA144AATJ*	3.35	3.30
REYA168AATJ*	3.30	3.30
REYA192AATJ*	3.40	3.48
REYA216AATJ*	3.35	3.35
REYA240AATJ*	3.30	3.30
REYA264AATJ*	3.25	3.70
REYA288AATJ*	3.25	3.45
REYA312AATJ*	3.20	3.40
REYA336AATJ*	3.20	3.40
REYA360AATJ*	3.20	3.40

REYA384AATJ*	3.20	3.35
REYA408AATJ*	3.20	3.35
REYA432AATJ*	3.20	3.30
REYA456AATJ*	3.20	3.30
REYA480AATJ*	3.20	3.30

MODEL NUMBER	SYSTEM COP@17°F (Ducted)	SYSTEM COP@17°F (Non-Ducted)
REYA72AATJ*	2.40	2.40
REYA96AATJ*	2.25	2.30
REYA120AATJ*	2.25	2.25
REYA144AATJ*	2.10	2.10
REYA168AATJ*	2.10	2.10
REYA192AATJ*	2.25	2.25
REYA216AATJ*	2.20	2.20
REYA240AATJ*	2.20	2.20
REYA264AATJ*	2.20	2.20
REYA288AATJ*	2.10	2.20
REYA312AATJ*	2.10	2.20
REYA336AATJ*	2.10	2.10
REYA360AATJ*	2.10	2.10
REYA384AATJ*	2.10	2.10
REYA408AATJ*	2.10	2.10
REYA432AATJ*	2.10	2.10
REYA456AATJ*	2.10	2.10
REYA480AATJ*	2.10	2.10

MODEL NUMBER	SYSTEM COP@5°F (Ducted)	SYSTEM COP@5°F (Non-Ducted)
REYA72AATJ*	1.64	1.75
REYA96AATJ*	1.75	1.81
REYA120AATJ*	1.64	1.75
REYA144AATJ*	1.91	1.96
REYA168AATJ*	1.85	1.85
REYA192AATJ*	1.84	1.77
REYA216AATJ*	1.68	1.66
REYA240AATJ*	1.55	1.59
REYA264AATJ*	1.75	1.81
REYA288AATJ*	1.75	1.81
REYA312AATJ*	1.75	1.76
REYA336AATJ*	1.65	1.75

REYA360AATJ*	1.75	1.81
REYA384AATJ*	1.78	1.82
REYA408AATJ*	1.76	1.75
REYA432AATJ*	1.68	1.75
REYA456AATJ*	1.66	1.62
REYA480AATJ*	1.61	1.55

Please note that the performance numbers provided here are for reference and are not AHRI rated

1. Performance Conditions:
   a. Cooling: Indoor temperature of 80°FDB (26.7°CDB), 67°FWB (19.5°CWB) and outdoor temperature of 95°FDB (35°CDB).
   b. Heating: Indoor temperature of 70°FDB (21.1°CDB) and outdoor temperature of 47°FDB (8.3°CDB), 43°FWB (6.1°CDB).
   c. Equivalent piping length: 25ft (7.5m)
2. Cooling Operation:
   a. The standard operating range in cooling will be 23°FDB (-5°CDB) ~ 122°FDB (50°CDB).
   b. Cooling mode indoor room temperature range will be 57-77°FWB (13.9 - 25°CWB).
3. Heating Operation:
   a. The standard operating range in heating will be -22° – 60°FWB (-30 – 15.6°CWB).
      1) If an alternate equipment manufacturer is selected, the mechanical contractor shall provide, at their own risk and cost, all additional material and labor to meet low ambient operating condition and performance.
   b. Heating mode indoor room temperature range will be 59°FDB - 80°F DB (15°CDB – 26.7°CDB).

B. ELECTRICAL:
   1. The power supply to the condensing unit shall be:

POWER SUPPLY VOLTAGE	VOLTAGE RANGE
460V / 3ph / 60 Hz	187V – 253V (±10%)

MODEL NUMBER	MCA	MOP
REYA72AATJ*	14.9	20
REYA96AATJ*	17.5	20
REYA120AATJ*	18.2	25
REYA144AATJ*	23.3	30
REYA168AATJ*	27.1	30
REYA192AATJ*	30.7	35
REYA216AATJ*	32.8	40

REYA240AATJ*	35.1	40
REYA264AATJ*	18.2+23.3	25+30
REYA288AATJ*	23.3+23.3	30+30
REYA312AATJ*	23.3+27.1	30+30
REYA336AATJ*	27.1+27.1	30+30
REYA360AATJ*	27.1+30.7	30+35
REYA384AATJ*	30.7+30.7	35+35
REYA408AATJ*	30.7 + 32.8	35+40
REYA432AATJ*	32.8+32.8	40+40
REYA456AATJ*	32.8+35.1	40+40
REYA480AATJ*	35.1+35.1	40+40

C. WIRING:
1. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded, stranded 2 conductor cable.
2. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one condensing unit with one 2-cable wire, thus simplifying the wiring installation.
3. The control wiring maximum lengths shall be as shown below:

	CONDENSER TO INDOOR UNIT	CENTRAL CONTROLLER TO FIRST ODU	INDOOR UNIT TO REMOTE CONTROL
CONTROL WIRING LENGTH	6,560ft (2,000m)	656FT (200m)	1640 ft. (500m)
WIRE TYPE	16/18 AWG, 2 wire, non-polarity, non-shielded, stranded		

D. REFRIGERANT PIPING:
1. The system shall be capable of refrigerant piping up to 540ft (165m) actual or 623ft (190m) equivalent from the condensing unit to the furthest indoor unit, a total combined liquid line length of 3,280ft (1,000m) of piping between the condensing and indoor units, without any oil traps or additional components.
2. REFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance.
   a. T-style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.

E. PAINT/CORROSION RESISTANCE:
1. Paint and corrosion resistance shall be at a minimum per the table below:

COMPONENT	VRV EMERION		
	BASE MATERIAL	SURFACE TREATMENT	COATING THICKNESS External & Internal Surface
EXTERNAL PANEL BASE	Galvanized steel	POLYESTER	≧1.5 mils
EXTERNAL FRONT PANEL	Galvanized steel	POLYESTER	≧1.5 mils
PILLAR	Galvanized steel	POLYESTER	≧1.5 mils
COMPRESSOR COVER	ASTM material	Resin Paint	≧0. 78 mils
FIN GUARD	Iron wire	Resin Paint	≧0. 79 mils
FAN GUARD AND DRUM	Polypropylene	No treatment required	N/A
FAN	Acrylonitrile - glass	No treatment required	N/A
FAN MOTOR FRAME	Resin	No treatment required	N/A
FAN MOTOR SHAFT	Carbon steel	No treatment required	N/A
FAN MOTOR SUPPORT	Galvanized steel	POLYESTER	≧1.5 mils
HEAT EXCHANGERS (FIN ONLY)	Aluminum	Polymer Anti-corrosion surface treatment	Salt Spray 1000 hours, blister rating 10
ELECTRICAL PARTS BOX	Hot-dip zinc-coated steel	No treatment required	N/A
ELECTRICAL PARTS BOARD	Glass cloth / Glass nonwoven cloth material	Insulation Varnish	No specific thickness
SCREWS	Carbon steel wire rods	High corrosion resistance treatment	≧0. 28 mils

2-.04 OUTDOOR/CONDENSING UNIT

A. GENERAL:

1. The condensing unit is designed specifically for use with R-32 VRV EMERION series components.

2. The refrigeration circuit of the condensing unit shall consist of Daikin inverter scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver, and suction accumulator.
3. Liquid and suction lines must be individually insulated between the condensing and indoor units.
4. The condensing unit can be wired and piped with access from the left, right, rear or bottom.
5. The connection ratio of indoor units to condensing unit shall be permitted up to 200% of nominal capacity.
6. Each condensing system shall be able to support the connection of up to 64 indoor units dependent on the model of the condensing unit.
7. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The condensing unit shall be capable of operating automatically at further reduced noise during nighttime or via an external input.
8. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
9. The condensing unit shall be modular in design and should allow for side-by-side installation.
10. The following safety devices shall be included on the condensing unit, high pressure sensor and switch, low pressure sensor low pressure switch control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
11. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.
12. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
13. The condensing unit shall be capable of heating operation at -22°F (-30°C) wet bulb ambient temperature without additional low ambient controls or an auxiliary heat source.

B. UNIT CABINET:
   1. The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proof galvanized steel panels coated with a baked enamel finish.
   2. Each condensing unit shall have a three-segment panel design which allows for direct access to outdoor fans, critical mechanical, and electrical components separately for ease of installation and service.

3. Each outdoor unit shall have separate knockouts for both refrigerant piping and wiring on the bottom panel.
4. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.
5. The condensing unit shall have configurable settings for intermittent fan operation to help minimize snow accumulation on fan blades when the system is off.
6. Each outdoor unit fan shall be a vertical discharge configuration, and the nominal airflow rate for each module will range from 6,210 CFM to 14,505 CFM dependent on the model specified.
7. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
8. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

B. SOUND:
   1. Nominal sound pressure levels shall be as shown below.

MODEL NUMBER	SOUND PRESSURE LEVEL dB(A)
REYA72AATJ*	58
REYA96AATJ*	61
REYA120AATJ*	61
REYA144AATJ*	65
REYA168AATJ*	65
REYA192AATJ*	67
REYA216AATJ*	68
REYA240AATJ*	69
REYA264AATJ*	67
REYA288AATJ*	69
REYA312AATJ*	69
REYA336AATJ*	69
REYA360AATJ*	70
REYA384AATJ*	71
REYA408AATJ*	71
REYA432AATJ*	72
REYA456AATJ*	72

REYA480AATJ*	73

2. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature. Operation sound level shall be selectable from 3 steps.

OPERATION SOUND dB(A)	NIGHT MODE SOUND PRESSURE LEVEL dB(A) APPROX.
Level 1	55
Level 2	50
Level 3	45

C. CONDENSER COIL:
1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
4. The fins shall be coated with an anti-corrosion hydrophilic blue coating as standard from factory with a salt spray test rating of 1000hr per ASTM B117 test standards.
5. The outdoor coil shall have three-circuit heat exchanger design eliminating the need for a drain pan heater. The lower part of the coil shall be used for inverter cooling and be on or off during operation enhancing the defrost operation.
   a. An alternate manufacturer must provide a drain pan heater to enable adequate defrosting of the unit in defrost operation.
6. The condensing unit shall be factory equipped with condenser coil guards on all sides.

F. COMPRESSOR:
1. The Daikin inverter scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit.
   a. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value.

1) Non–inverter-driven compressors, which may cause starting motor current to exceed the nominal motor current (RLA) and require larger wire sizing, shall not be allowed.

2. The inverter driven compressors in the condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “P-type.”
3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type.
   a. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
4. The capacity control range shall be as low as 1% to 100%.
5. The compressor’s motor shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.
6. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
7. Oil separators shall be standard with the equipment together with an intelligent oil management system.
8. The compressor shall be mounted on vibration dampening rubber grommets to minimize the transmission of vibration, eliminating the standard need for external spring isolation.
9. In the event of compressor failure, the remaining compressors, if applicable, shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be manually activated to specifically address this condition for single module and manifold systems.
10. In the case of multiple condenser modules, combined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours. When connected to a central control system, sequential start is activated for all systems on each D4 network.

2.05 HVAC EQUIPMENT ALTERNATE

1) <u>The alternate equipment supplier shall provide to the bidding mechanical contractor a complete equipment data package.</u>
   a) This package shall include, but is not limited to, equipment capacities at the design condition, power requirements, indoor units CFM/static pressures, fan curves, installation requirements, and physical dimensions. Nominal performance data is not acceptable.

b) The mechanical contractor shall request and receive the equipment data package 15 days prior to bid date and submit this package with the alternate bid.
c) The mechanical contractor shall list the equipment supplier and submit the required data package with the bid detailing a complete comparison of the proposed alternate equipment to the specified equipment and the associated cost reduction of the alternate equipment. The contractor bids an alternate manufacturer with full knowledge that that manufactures product may not be acceptable or approved.
d) All equipment must have visible and permanent label clearly identifying the original manufacturer of the equipment. These labels shall have original manufacturer's name and contact information and be located both inside and outside the equipment and on all equipment-related literature. Submittals shall include the above statement as confirmation by supplier that all conditions are agreed to and complied to. Failure to comply with these requirements shall be sufficient cause for rejection of the submittal and product with no further consideration.

2) The alternate equipment supplier shall furnish a complete drawing package to the mechanical contractor 15 days prior to bid day for bidding and installation.
   a) The drawing format shall be .dxf or equivalent, on 30"x42" sheets.
   b) The HVAC and electrical series design documents will be made available in electronic format for use by the equipment supplier in preparing their drawings.
   c) The alternate equipment supplier shall prepare the following drawings:
      i) XXX HVAC Floor Plan
      ii) XXX HVAC Refrigerant Piping Plan
      iii) XXX HVAC Refrigerant Piping/Controls Details
      iv) XXX HVAC Details
      v) XXX HVAC Schedules
   d) The alternate equipment supplier shall draft all piping circuits, components, overall building control schematic, detailed control wiring diagrams, system details, and schedules for their system. The drawings shall convey all requirements to successfully install the alternate equipment supplier's system.
   e) Provide (2) drawing package sets plotted on 20 lb. vellum. Provide (1) drawing package in electronic format (.dxf files) on CD.
   f) The submitted documents shall be complete system designs and show no less information than the HVAC equipment/controls contract bid documents.
3) The equipment supplier shall submit, as part of the equipment data package, condensing unit data sheets. Data sheets to include the following:
   a) COOLING capacities at project design conditions:
      i) Cooling (Btu/h)
      ii) Cooling Input Power:
         (1) Ducted (kW)
         (2) Ductless (kW)
         (3) Mixed (kW)

iii) Part Load IEER:
(1) Ducted
(2) Ductless
(3) Mixed
iv) Full Load EER:
(1) Ducted
(2) Ductless
(3) Mixed

b) HEATING capacities at project design conditions:
i) Heating (Btu/h)
ii) Heating Input Power:
(1) Ducted (kW)
(2) Ductless (kW)
(3) Mixed (kW)
iii) Full Load COP @ 47°F:
(1) Ducted
(2) Ductless
(3) Mixed
iv) Full Load COP @ 17°F:
(1) Ducted
(2) Ductless
(3) Mixed

c) The submitted capacity and efficiency performance must meet or exceed the listed performance on the schedule at the designed space conditions including de-rate factors for defrost if applicable and refrigerant piping losses.
i) OPERATING TEMPERATURE RANGE:
(1) Cooling
(2) Heating
ii) POWER SUPPLY:
(1) Maximum Circuit Amps (MCA)
(2) Maximum Overcurrent Protection Amps (MOP)
(3) Maximum Starting Current (MSC)
(4) Condenser Fan Motor
iii) REFRIGERANT:
(1) Refrigerant type and charge details including field charge for piping to ensure code compliance.
(2) Control of refrigerant temperature based on weather and load or alternative function.
iv) UNIT DATA:
(1) Max. number of indoor units
(2) Sound pressure level at 3ft (dBA)
(3) Weight (lbs.)
(4) Dimensions

(5) Demand limit function description
(6) Details on sequential start functionality
(7) Coil anticorrosion data

4) The equipment supplier shall guarantee the performance of their system and all published data submitted. Performance shall be based on the design criteria below.
   a) Room Temperature (Cooling)
   b) Room Temperature (Heating)
   c) Ambient Temperature (Summer)
   d) Ambient Temperature (Winter)
   e) Defrost De-rate Factor
   f) Refrigerant Piping Loss
5) The alternate equipment supplier shall submit with bid, indoor unit data sheets. Data sheets to include the following:
   a) Capacities at project design conditions:
      i) Cooling (Btu/h)
      ii) Cooling Input Power (kW)
      iii) Part Load IEER
      iv) Full Load EER
      v) Heating (Btu/h)
      vi) Heating Input Power (kW)
      vii) Full Load COP@47°F
      viii) Full Load COP@17°F
      ix) Air Flow (CFM)
   b) External Static Pressure (ESP)
   c) Electrical Data (MAC, MOP, MSC, RLA)
   d) Weight (lbs.)
   e) Dimensions
6) The equipment supplier shall provide a certificate which states that the equipment has a minimum salt spray resistance of 1000 hours.
7) The equipment supplier shall submit the warranty certificate to the mechanical contractor.

Part 1 – GENERAL

VARIABLE REFRIGERANT VOLUME (VRV / VRV-S) AIR CONDITIONING

SPECIFICATION – Heat Recovery/Heat Pump Indoor Units

1.01 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 60335-2-40 – Heating and Cooling Equipment and bear the Listed Mark.
B. All wiring shall be in accordance with the National Electric Code (NEC)/Canadian Electrical Code (CEC).
C. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
D. The outdoor unit will be factory charged with R32.

1.02 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

Part 2 – WARRANTY

2.01 STANDARD LIMITED WARRANTY

Daikin North America LLC warrants original owner of the non-residential building, multifamily residence, or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ''installation date'' which is one of the two dates below:

a. The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit's rating plate.
b. If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.

Complete warranty details are available from your local Daikin representative or at www.daikincomfort.com.

Part 3 – PERFORMANCE

3.01 DESIGN BASIS

1. The HVAC equipment Basis of Design is Daikin.
2. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Key General Specifications Alternate Supplier Checklist). In any event the contractor shall be responsible for all specified items and intents of this document without further compensation.
3. Any efforts to bid with alternate manufactures shall satisfy Part 5 of this specification.

Part 4 – PRODUCTS

4.01 FXAA – WALL MOUNTED UNIT

A. General:
   1. Daikin indoor unit FXAA shall be a wall mounted fan coil unit, operable with refrigerant R-32, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space.
   2. This compact design with finished white casing shall be available in capacities from 5,400 Btu/h to 24,000 Btu/h. Model numbers are FXAA05AAVJU, FXAA07AAVJU, FXAA09AAVJU, FXAA12AAVJU, FXAA18AAVJU and FXAA24AAVJU to be connected to outdoor unit model RXYA/RXTA Heat Pump and REYA Heat Recovery model as well as other ODU units.
   3. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1NRV71.
   4. A mildew-proof, polystyrene condensate drain pan, and resin net mold resistant filter shall be included as standard equipment.
   5. The indoor units sound pressure shall range from 51 dB(A) to 63 dB(A) at low speed measured at 3.3 feet below and from the unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)

FXAA05AAVJU	5,400	6,100
FXAA07AAVJU	7,500	8,500
FXAA09AAVJU	9,500	10,500
FXAA12AAVJU	12,000	13,500
FXAA18AAVJU	18,000	20,000
FXAA24AAVJU	24,000	26,500

C. Indoor Unit:
   1. The Daikin indoor unit FXAA shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drainpipe can be fitted to from either left or right sides.
   2. The indoor unit shall have a factory installed refrigerant leak sensor built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. The unit shall have signal output directly or through an accessory PCB in event of leak to connect to external ventilation, damper, alarm etc.,
   3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   4. Both refrigerant lines shall be insulated from the outdoor unit.
   5. Return air shall be through a resin net mold resistant filter.
   6. The indoor units shall be equipped with a condensate pan.
   7. The indoor units shall be equipped with a return air thermistor.
   8. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   9. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
   1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
   2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
1. The fan shall be a direct-drive crossflow fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 28W – 58W.
3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.

F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The refrigerant connections shall be flare connections and the condensate will be 5/8 inch outside diameter PVC.
4. A thermistor will be located on the liquid and gas line.
5. A condensate pan shall be located in the unit.

G. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3. The unit shall be compatible with a Daikin Hero System advanced multi-zone controller.

4.02 FXFA – ROUND FLOW SENSING CEILING CASSETTE UNIT

A. General:
1. Daikin indoor unit model FXFA shall be a round flow ceiling cassette fan coil unit, operable with R32 refrigerant, equipped with

an electronic expansion valve, refrigerant leak sensor, direct drive DC (ECM) type fan, for installation into the ceiling cavity equipped with an air panel grill.

2. It shall be available in capacities from 7,200 Btu/h to 54,000 Btu/h. Model numbers are FXFA07AAVJU, FXFA09AAVJU, FXFA12AAVJU, FXFA15AAVJU, FXFA18AAVJU, FXFA24AAVJU, FXFA30AAVJU, FXFA36AAVJU, FXFA48AAVJU, FXFA54AAVJU to be connected to outdoor unit models RXTA, RXYA, RXLA Heat Pumps and REYA and RELA Heat Recovery and RWEA Water Cooled Units.
3. Shall be a round flow air distribution type, fresh white, impact resistant decoration panel, or optional self-cleaning filter panel.
4. The supply air is distributed via four individually motorized louvers.
5. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition.
6. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1NRV71.
7. The indoor units sound pressure shall range from 30 dB(A) to 45 dB(A) at High speed measured at 5 feet below the unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXFA07AAVJU	7,200	8,500
FXFA09AAVJU	9,500	10,500
FXFA12AAVJU	12,000	13,500
FXFA15AAVJU	14,400	17,000
FXFA18AAVJU	18,000	20,000
FXFA24AAVJU	23,000	27,000
FXFA30AAVJU	30,000	34,000

FXFA36AAVJU	36,000	40,000
FXFA48AAVJU	48,000	54,000
FXFA54AAVJU	54,000	60,000

C. Indoor Unit:
1. The Daikin indoor unit FXFA shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2. The indoor unit shall have a factory installed refrigerant leak sensor built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. The unit shall have signal output in event of leak to connect to external ventilation, damper, alarm etc.
3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
4. Both refrigerant lines shall be insulated from the outdoor unit.
5. The round flow supply air flow can be field modified to 18 different airflow patterns to accommodate various installation configurations including corner installations.
6. Return air shall be through the concentric panel, which includes a resin net, mold resistant, antibacterial filter.
7. The indoor units shall be equipped with a condensate pan with antibacterial treatment and condensate pump. The condensate pump provides up to 33-1/2 lift from bottom of unit to top of drain piping and has a built-in safety shutoff and alarm.
8. The indoor units shall be equipped with a return air thermistor.
9. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
10. The voltage range will be 253 volts maximum and 187 volts minimum.
11. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor.
12. Supplied air shall be directed automatically by four individually controlled louvers.

D. Unit Cabinet:
1. The cabinet shall be space-saving and shall be located onto the ceiling.

2. Four auto-adjusted louvers shall be available to choose, which include standard, draft prevention, and ceiling stain prevention.
3. The air flow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.
4. Fresh air intake shall be possible by way of Daikin's optional fresh air intake kit.
5. A branch duct knockout shall exist for branch ducting of supply air.
6. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
7. Optional high-efficiency air filters are available for each model unit.

E. Fan:
1. The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.08 to 0.16 HP.
3. The airflow rate shall be available in three manual settings.
4. The DC fan shall be able to automatically adjust the fan speed in 5 speeds based on the space load.
5. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings to allow operation with the high efficiency air filter options.
6. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin and antibacterial treatment.
2. Optional high efficiency disposable air filters shall be available.
3. Optional Self-Cleaning Filter Panel, which performs automatic filter cleaning up to once a day, with dust collection box that indicates when to be emptied.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2, or 3-row cross fin copper evaporator coil with up to 21 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 1 -1/4 inch outside diameter PVC.
5. A condensate pan with antibacterial treatment shall be located under the coil.

6. A thermistor will be located on the liquid and gas line.

H. Electrical:
   1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
   2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
   1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
   2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
   3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.
   4. For the Sensing functions and the optional Self-Cleaning Filter functions, Remote controller BRC1NRV71 shall be used. Consult with Daikin prior to applying controls.

J. Optional Accessories Available:
   1. A high efficiency disposable air filter kit
   2. Air intake kit
   3. Self-Cleaning Filter Panel, which performs automatic filter cleaning up to once a day, with dust collection box that indicates when to be emptied.
   4. Remote “in-room” sensor kit (KRCS01-6B).
      i. The Daikin wall mounted, hard wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

4.03 FXMA - CONCEALED CEILING DUCTED UNIT (High Static)

A. General Requirements:
   1. All indoor/evaporator units shall be factory assembled and tested DX-fan coil units, operable with refrigerant R32.
   2. It shall be available in capacities from 15,000 Btu/h to 57,000 Btu/h. Model numbers are FXMA15AAVJU, FXMA18AAVJU, FXMA24AAVJU,

FXMA30AAVJU, FXMA36AAVJU, FXMA48AAVJU, FXMA54AAVJU to be connected to outdoor unit models RXTA, RXYA, RXLA Heat Pumps and REYA and RELA Heat Recovery and RWEA Water Cooled Units.

3. All units shall be completely factory assembled and tested and shall be charged with dehydrated air prior to shipment from the factory.
4. All units shall be equipped with an electronic expansion valve controlled using a PID loop to automatically adjust the refrigerant flow rate through the unit.
5. All units shall be equipped with a programmed drying operation that dehumidifies while limiting changes in room temperature when used with Daikin remote controllers BRC1NRV71.
6. All units shall feature self-diagnostics, auto-restart functionality, 3-minute fused time delay, and a test run switch.
7. All refrigerant piping, both liquid and suction, shall be fully insulated from the outdoor unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Btu/h) (Indoor 80°FDB / 67°FWB, Outdoor 95°FDB, 25 ft pipe length)	Heating (Btu/h) (Indoor 70°FDB, Outdoor 47°FDB / 43°FWB, 25 ft pipe length)
FXMA15AAVJU	15,000	17,000
FXMA18AAVJU	18,000	20,000
FXMA24AAVJU	24,000	27,000
FXMA30AAVJU	30,000	34,000
FXMA36AAVJU	36,000	40,000
FXMA48AAVJU	48,000	54,000
FXMA54AAVJU	57,000	63,000

C. Indoor Unit:
1. The Daikin indoor unit FXMA shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay,

and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.

2. The indoor unit shall have a factory installed refrigerant leak sensor built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. Signal will be sent to shut compressor and close safety shut off valve in BS Box or Dedicated SSOV as needed. The unit shall have signal output directly or through an accessory PCB in event of leak to connect to external ventilation, damper, alarm etc.
3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
4. Both refrigerant lines shall be insulated from the outdoor unit.
5. The indoor units shall be equipped with a return air thermistor.
6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
7. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
   1. The unit cabinet shall be constructed of heavy gauge galvanized steel.
   2. The unit shall be internally insulated and shall be capable of installation in indoor environments up to 80% relative humidity without requiring additional field installed insulation.
   3. The unit shall ship from the factory in a rear-return configuration and shall be field-convertible to a bottom-return configuration.
   4. The unit shall be equipped with a return air thermistor.
   5. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

E. Fan:
   1. The fan shall be a direct-drive, brushless DC fan motor with (3) user-selectable fan speeds (H, M, L).
   2. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
   3. The unit shall be equipped with internal controls to allow the fan to automatically select the operating fan curve to deliver nominal airflow CFM (within +/- 10%) when the connect ductwork has been designed with a total external static within the range of the FXMA. This setting shall be accessible as a setting to be used during startup and commissioning of the system.
   4. The fan motor shall be capable of Auto fan speed control when the unit is connected to the BRC1NRV71 Navigation Remote Control. The Auto fan speed control shall automatically adjust the unit’s fan speed in response to the difference between the indoor unit’s current set point and the

current room temperature measurement. The Auto fan speed control shall utilize (5) fan speeds.
5. The fan motor shall be internally isolated using rubber grommets to reduce transmission of vibrations to the unit.
6. The airflow rate shall be available in three settings.
7. The fan motor shall be thermally protected.
8. Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. w.g.)
FXMA15AAVJU	0.20 – 0.80
FXMA18AAVJU	0.20 – 0.80
FXMA24AAVJU	0.20 – 0.80
FXMA30AAVJU	0.20 – 0.80
FXMA36AAVJU	0.20 – 0.80
FXMA48AAVJU	0.20 – 0.80
FXMA54AAVJU	0.20 – 0.56

F. Fan Blade
1. The fan blade shall be constructed of lightweight polymer.
2. The fan blade shall be statically and dynamically balanced to minimize vibration.

G. Coil:
1. Coils shall be of the direct expansion type, constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be 2 or 3 row cross fin copper evaporator coil with 18 fpi design, completely factory tested.
4. The refrigerant connections shall be flare connections.
5. Factory mounted thermistors shall be installed on the liquid and gas lines.

H. Condensate Drainage
1. The unit shall be equipped with a condensate drain pan under the coil.
2. The condensate drain outlet shall be of PVC construction and VP25 (1” ID, 1-1/4” OD).
3. The unit shall be equipped with a factory-integral condensate pump capable of 25-5/16” lift from the condensate drain outlet. The condensate pump shall be equipped with a float switch to automatically stop unit

operation and provide a system error code in the event drain pan water level rises too high.

I. Electrical:
1. Provide a separate power supply connection of 208/230V, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
2. Refer to the engineering data book for all other electrical data including MCA, MOCP, and FLA values.
3. The transmission (control) wiring distance between the indoor unit and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
4. The transmission (control) wiring between the indoor unit and the remote controller shall be a maximum distance of 1,640 feet.

J. Control:
1. The unit shall be controlled with a Daikin remote controller to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a building management system (BMS) via optional BACnet or LonWorks gateways.
3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

K. Optional Accessories Available:
1. BRC1NRV71 Navigation Remote Controller (wired)
2. KRCS01-6B Remote Sensor

4.04 FXMA – LARGE CAPACITY CONCEALED CEILING DUCTED UNIT (High Static)

A. General Requirements:
1. All indoor/evaporator units shall be factory assembled and tested DX-fan coil units, operable with refrigerant R32.
2. It shall be available in capacities from 72,000 Btu/h and 96,000 Btu/h. Model numbers are FXMA72AAVJU and FXMA96AAVJU to be connected to outdoor unit models RXYA Heat Pumps, REYA, RELA Heat Recovery and RWEA Water Cooled Units
3. All units shall be completely factory assembled and tested and shall be charged with dehydrated air prior to shipment from the factory.
4. All units shall be equipped with an electronic expansion valve controlled using a PID loop to automatically adjust the refrigerant flow rate through the unit.

5. All units shall be equipped with a programmed drying operation that dehumidifies while limiting changes in room temperature when used with Daikin remote controllers BRC1NRV71.
6. All units shall feature self-diagnostics, auto-restart functionality, 3-minute fused time delay, and a test run switch.
7. All refrigerant piping, both liquid and suction, shall be fully insulated from the outdoor unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Btu/h) (Indoor 80°FDB / 67°FWB, Outdoor 95°FDB, 25 ft pipe length)	Heating (Btu/h) (Indoor 70°FDB, Outdoor 47°FDB / 43°FWB, 25 ft pipe length)
FXMA72AAVJU	72,000	81,000
FXMA96AAVJU	96,000	108,000

C. Indoor Unit:
1. The Daikin indoor unit FXMA shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.
2. The indoor unit shall have a factory installed refrigerant leak sensor built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. Signal will be sent to shut compressor and close safety shut off valve in BS Box or Dedicated SSOV as needed. The unit shall have signal output directly or through an accessory PCB in event of leak to connect to external ventilation, damper, alarm etc.
3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
4. Both refrigerant lines shall be insulated from the outdoor unit.
5. The indoor units shall be equipped with a return air thermistor.
6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.

7. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
   1. The unit cabinet shall be constructed of heavy gauge galvanized steel.
   2. The unit shall be internally insulated and shall be capable of installation in indoor environments up to 80% relative humidity without requiring additional field installed insulation.
   3. The unit shall ship from the factory in a rear-return configuration and shall be field-convertible to a bottom-return configuration.
   4. The unit shall be equipped with a return air thermistor.
   5. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

E. Fan:
   1. The fan shall be a direct-drive, brushless DC fan motor with (3) user-selectable fan speeds (H, M, L).
   2. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
   3. The unit shall be equipped with internal controls to allow the fan to automatically select the operating fan curve to deliver nominal airflow CFM (within +/- 10%) when the connect ductwork has been designed with a total external static within the range of the FXMA. This setting shall be accessible as a setting to be used during startup and commissioning of the system.
   4. The fan motor shall be capable of Auto fan speed control when the unit is connected to the BRC1NRV71 Navigation Remote Control. The Auto fan speed control shall automatically adjust the unit's fan speed in response to the difference between the indoor unit's current set point and the current room temperature measurement. The Auto fan speed control shall utilize (5) fan speeds.
   5. The fan motor shall be internally isolated using rubber grommets to reduce transmission of vibrations to the unit.
   6. The airflow rate shall be available in three settings.
   7. The fan motor shall be thermally protected.
   8. Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. w.g.)
FXMA72AAVJU	0.20 – 1.0
FXMA96AAVJU	0.20 – 1.0

F. Fan Blade
   1. The fan blade shall be constructed of lightweight polymer.

2. The fan blade shall be statically and dynamically balanced to minimize vibration.

G. Coil:
   1. Coils shall be of the direct expansion type, constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3. The refrigerant connections shall be flare connections.
   4. Factory mounted thermistors shall be installed on the liquid and gas lines.

H. Condensate Drainage
   1. The unit shall be equipped with a condensate drain pan under the coil.
   2. The condensate drain outlet shall be of PVC construction and VP25 (1" ID, 1-1/4" OD).
   3. The unit shall be equipped with a factory-integral condensate pump capable of 25-5/16" lift from the condensate drain outlet. The condensate pump shall be equipped with a float switch to automatically stop unit operation and provide a system error code in the event drain pan water level rises too high.

I. Electrical:
   1. Provide a separate power supply connection of 208/230V, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
   2. Refer to the engineering data book for all other electrical data including MCA, MOCP, and FLA values.
   3. The transmission (control) wiring distance between the indoor unit and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   4. The transmission (control) wiring between the indoor unit and the remote controller shall be a maximum distance of 1,640 feet.

J. Control:
   1. The unit shall be controlled with a Daikin remote controller to perform input functions necessary to operate the system.
   2. The unit shall be compatible with interfacing with a building management system (BMS) via optional BACnet or LonWorks gateways.
   3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

K. Optional Accessories Available:
   1. BRC1NRV71 Navigation Remote Controller (wired)
   2. KRCS01-6B Remote Sensor
   3. KRP1C76 Wiring adapter PCB
   4. KRP4A71 Group Control Adaptor PCB

4.05 FXSA - CONCEALED CEILING DUCTED UNIT (Med. Static)

A. General Requirements:
   1. All indoor/evaporator units shall be factory assembled and tested DX-fan coil units, operable with refrigerant R32.
   2. All units shall be completely factory assembled and tested and shall be charged with dehydrated air prior to shipment from the factory.
   3. All units shall be equipped with an electronic expansion valve controlled using a PID loop to automatically adjust the refrigerant flow rate through the unit.
   4. All units shall be equipped with a programmed drying operation that dehumidifies while limiting changes in room temperature when used with Daikin remote controllers BRC1NRV71.
   5. All units shall feature self-diagnostics, auto-restart functionality, 3-minute fused time delay, and a test run switch.
   6. All refrigerant piping, both liquid and suction, shall be fully insulated from the outdoor unit.

B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Btu/h) (Indoor 80°FDB / 67°FWB, Outdoor 95°FDB, 25 ft pipe length)	Heating (Btu/h) (Indoor 70°FDB, Outdoor 47°FDB / 43°FWB, 25 ft pipe length)
FXSA05AAVJU	5,800	6,500
FXSA07AAVJU	7,200	8,500
FXSA09AAVJU	9,500	10,500
FXSA12AAVJU	12,000	13,500
FXSA15AAVJU	15,000	17,000
FXSA18AAVJU	18,000	20,000
FXSA24AAVJU	24,000	27,000
FXSA30AAVJU	30,000	34,000

FXSA36AAVJU	36,000	40,000
FXSA48AAVJU	48,000	54,000
FXSA54AAVJU	54,000	60,000

C. Indoor Unit:
1. The Daikin indoor unit FXSA shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.
2. The indoor unit shall have a factory installed refrigerant leak sensor built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. Signal will be sent to shut compressor and close safety shut off valve in BS Box or Dedicated SSOV as needed. The unit shall have signal output directly or through an accessory PCB in event of leak to connect to external ventilation, damper, alarm etc.
3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
4. Both refrigerant lines shall be insulated from the outdoor unit.
5. The indoor units shall be equipped with a return air thermistor.
6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
7. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
1. The unit cabinet shall be constructed of heavy gauge galvanized steel.
2. The unit shall be internally insulated and shall be capable of installation in indoor environments up to 80% relative humidity without requiring additional field installed insulation.
3. The unit shall ship from the factory in a rear-return configuration and shall be field-convertible to a bottom-return configuration.
4. The unit shall be equipped with a return air thermistor.
5. The cabinet shall be constructed with sound absorbing foamed fiber-less closed cell polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be a direct-drive, brushless DC fan motor with (3) user-selectable fan speeds (H, M, L).
2. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
3. The unit shall be equipped with internal controls to allow the fan to automatically select the operating fan curve to deliver nominal airflow CFM (within +/- 10%) when the connect ductwork has been designed with a total external static within the range of the FXSA. This setting shall be accessible as a setting to be used during startup and commissioning of the system.
4. The fan motor shall be capable of Auto fan speed control when the unit is connected to the BRC1NRV71 Navigation Remote Control. The Auto fan speed control shall automatically adjust the unit's fan speed in response to the difference between the indoor unit's current set point and the current room temperature measurement. The Auto fan speed control shall utilize (5) fan speeds.
5. The fan motor shall be internally isolated using rubber grommets to reduce transmission of vibrations to the unit.
6. The airflow rate shall be available in three settings.
7. The fan motor shall be thermally protected.
8. Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. w.g.)
FXSA05AAVJU	0.12 – 0.60
FXSA07AAVJU	0.12 – 0.60
FXSA09AAVJU	0.12 – 0.60
FXSA12AAVJU	0.12 – 0.60
FXSA15AAVJU	0.12 – 0.60
FXSA18AAVJU	0.20 – 0.60
FXSA24AAVJU	0.20 – 0.60
FXSA30AAVJU	0.20 – 0.60
FXSA36AAVJU	0.20 – 0.60
FXSA48AAVJU	0.20 – 0.60
FXSA54AAVJU	0.20 – 0.56

F. Fan Blade
   1. The fan blade shall be constructed of lightweight polymer.
   2. The fan blade shall be statically and dynamically balanced to minimize vibration.

G. Coil:
   1. Coils shall be of the direct expansion type, constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3. The coil shall be 2 or 3 row cross fin copper evaporator coil with 18 fpi design, completely factory tested.
   4. The refrigerant connections shall be flare connections.
   5. Factory mounted thermistors shall be installed on the liquid and gas lines.

H. Condensate Drainage
   1. The unit shall be equipped with a condensate drain pan under the coil.
   2. The condensate drain outlet shall be of PVC construction and VP25 (1” ID, 1-1/4” OD).
   3. The unit shall be equipped with a factory-integral condensate pump capable of 25-5/16” lift from the condensate drain outlet. The condensate pump shall be equipped with a float switch to automatically stop unit operation and provide a system error code in the event drain pan water level rises too high.

I. Electrical:
   1. Provide a separate power supply connection of 208/230V, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
   2. Refer to the engineering data book for all other electrical data including MCA, MOCP, and FLA values.
   3. The transmission (control) wiring distance between the indoor unit and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   4. The transmission (control) wiring between the indoor unit and the remote controller shall be a maximum distance of 1,640 feet.

J. Control:
   1. The unit shall be controlled with a Daikin remote controller to perform input functions necessary to operate the system.
   2. The unit shall be compatible with interfacing with a building management system (BMS) via optional BACnet or LonWorks gateways.
   3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

K. Optional Accessories Available:

1. BRC1NRV71Navigation Remote Controller (wired)
2. KRCS01-6B Remote Sensor

4.06 FXTA – MULTI-POSITION AIR HANDLING UNIT

A. General:
   1. Daikin indoor unit FXTA shall be a floor mounted vertical, horizontal left, horizontal right, or downflow air handling unit, operable with refrigerant R32, equipped with an electronic expansion valve and direct-drive ECM type fan with constant CFM programming, for installation within a conditioned space.
   2. When installed in a vertical configuration it shall have top discharge air and bottom return air. When installed in a horizontal right or horizontal left configuration, it shall have a horizontal discharge air and horizontal return air. When installed in a downflow configuration it shall have bottom discharge and top return air.
   3. This compact design with pre-painted heavy-gauge steel casing shall be available in capacities from 9,500 Btu/h to 60,000 Btu/h. Model numbers are FXTA09AAVJUA, FXTA12AAVJUA, FXTA18AAVJUA, FXTA24AAVJUA, FXTA30AAVJUA, FXTA36AAVJUA, FXTA42AAVJUA, FXTA48AAVJUA, FXTA54AAVJUA, and FXTA60AAVJUA to be connected to outdoor unit model RXTA VRV-S Heat Pump.
   4. The FXTA series may also be specified to utilize a factory integral disconnect switch. Model numbers including the factory disconnect are FXTA09AAVJUD, FXTA12AAVJUD, FXTA18AAVJUD, FXTA24AAVJUD, FXTA30AAVJUD, FXTA36AAVJUD, FXTA42AAVJUD, FXTA48AAVJUD, FXTA54AAVJUD, and FXTA60AAVJUD.
   5. A KRCS01-6B remote temperature sensor kit shall be required for all FXTA indoor units not utilizing the thermistor in the Daikin remote controller BRC1NRV71. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition.
   6. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1NRV71.

B. Performance: Each unit’s performance is based on nominal operating conditions

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXTA09AAVJUA(D)	9,500	10,500
FXTA12AAVJUA(D)	12,000	13,500
FXTA18AAVJUA(D)	18,000	20,000
FXTA24AAVJUA(D)	24,000	27,000
FXTA30AAVJUA(D)	30,000	34,000
FXTA36AAVJUA(D)	36,000	40,000
FXTA42AAVJUA(D)	42,000	47,500

FXTA48AAVJUA(D)	48,000	54,000
FXTA54AAVJUA(D)	54,000	61,000
FXTA60AAVJUA(D)	60,000	68,000

C. Indoor Unit:
   1. The Daikin indoor unit FXTA_AA components shall be completely factory assembled and tested. Included in the unit are factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, brazed connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   2. The indoor unit shall have a factory installed refrigerant leak sensor built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. Signal will be sent to shut compressor and close safety shut off valve in BS Box or Dedicated SSOV as needed. The unit shall have signal output directly or through an accessory PCB in event of leak to connect to external ventilation, damper, alarm etc.
   3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   4. Both refrigerant lines shall be insulated from the outdoor unit.
   5. Return air shall be through an optional or field supplied filter.
   6. Condensate draining shall be made via gravity or external condensate pump.
   7. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.

8. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
1. The cabinet shall be constructed with sound absorbing, foil-faced insulation to control air leakage.
2. Select an installation location with adequate structural support, space for service access and clearance for air return and supply duct connections.
3. A field supplied secondary drain pan shall be installed where required by national, state, or local code.

E. Fan:
1. The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.2 to 1.0. HP.
3. The airflow rate shall be available in high setting.
4. The fan motor shall be thermally protected.
5. Fan motor external static pressure for nominal airflow:

Model Number	Fan ESP (in. WG)
FXTA09AAVJUA(D)	Up to 0.9
FXTA12AAVJUA(D)	Up to 0.9
FXTA18AAVJUA(D)	Up to 0.9
FXTA24AAVJUA(D)	Up to 0.9
FXTA30AAVJUA(D)	Up to 0.9
FXTA36AAVJUA(D)	Up to 0.9
FXTA42AAVJUA(D)	Up to 0.9
FXTA48AAVJUA(D)	Up to 0.9
FXTA54AAVJUA(D)	Up to 0.9
FXTA60AAVJUA(D)	Up to 0.9

F. Filter:

1. The return air shall be filtered by means of an optional or field supplied filter.

G. Coil:
   1. Coils shall be of the direct expansion type constructed from aluminum tubes expanded into aluminum fins to form a mechanical bond.
   2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3. The coils shall be a 2- to 4-row cross fin copper evaporator coil with 14 to 16 fpi design completely factory tested.
   4. The refrigerant connections shall be brazed connections, and the condensate will be 3/4 inch outside diameter PVC.
   5. A thermistor will be located on the liquid and gas line.

H. Electrical:
   1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
   2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
   1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
   2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
   3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

J. Optional Accessories Available:
   1. Field installed 3-25kW electric heaters (HKTS-03, HKTS-05, HKTS-06, HKTS-08, HKTS-10, HKTS-15, HKTS-19, HKTS-20, HKTS-25).
   2. Remote sensor KRCS01-6B
   3. BRC1NRV71 wireless controller.

4.07 FXZA - VISTA™ 2x2 CASSETTE UNIT

A. General:

1. Daikin indoor unit model FXZA-AAVJU shall be a ceiling cassette fan coil unit, operable with R32 refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB / 60°F WB, Outdoor 47°F DB, 25 ft pipe length)
FXZA05AAVJU	5,800	6,500
FXZA07AAVJU	7,500	8,500
FXZA09AAVJU	9,500	10,500
FXZA12AAVJU	12,000	13,500
FXZA15AAVJU	15,000	17,000
FXZA18AAVJU	18,000	20,000

   equipped with a decoration panel grille.
2. It shall be available in capacities from 5,800 Btu/h to 18,000 Btu/h. Model numbers are FXZA05AAVJU, FXZA07AAVJU, FXZA09AAVJU, FXZA12AAVJU, FXZA15AAVJU, FXZA18AAVJU to be connected to outdoor unit model RXYA / RWEA / RXLA heat pump and REYQ / RELA / RWEA heat recovery model.
3. The decoration panel shall be a four-way air distribution type, impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition.
4. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote controls.
5. The indoor units sound pressure shall range from 25.5 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.

B. Performance: Each unit’s performance is based on nominal operating conditions:

C. Indoor Unit:
   1. The Daikin indoor unit FXZA-AAVJU shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   2. The indoor unit shall have a factory installed refrigerant leak sensor built in. If a leak is detected, the unit shall go into circulation mode and provide full airflow. Signal will be sent to shut compressor and close safety shut off valve in BS Box or Dedicated SSOV as needed. The unit shall have signal output directly or through an accessory PCB in event of leak to connect to external ventilation, damper, alarm etc.
   3. Both refrigerant lines shall be fully insulated from the outdoor unit or nearest branch connection into the refrigerant network.
   4. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
   5. Return air shall be through the concentric panel, which includes a resin net mold-resistant filter.
   6. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 24-13/16” of lift, measured from the drain outlet, and has a built-in safety shutoff and alarm.
   7. The indoor units shall be equipped with a return air thermistor.
   8. The indoor unit will be powered with 208~230V/1-phase/60Hz.
   9. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:
   1. The cabinet shall be space-saving and shall be located onto the ceiling.
   2. Three auto-swing positions shall be available to choose from via field setting.
   3. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
   4. Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
   5. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Decoration Panel:
   The FXZA-AAVJU series shall be compatible with the following decoration panel - VISTA Decoration panel.

   1. The decoration panel shall be a four-way air distribution type and constructed of impact resistant polymer.
   2. The decoration panel dimensions shall measure 24-7/16” x 24-7/16” and shall fit into a standard 2x2 ceiling grid with no overlap of adjacent tiles.
   3. The four air discharge outlet louvers shall be independently motorized and controllable. Each louver shall have a visual indicator to easily identify the louver and simplify the airflow configuration.
   4. The louver outlets shall be capable of closure to allow for 3-way and 2-way air distribution.
   5. The decoration panel shall be a low-profile design, extending 5/16” below the ceiling.
   6. The decoration panel shall be compatible with the optional space and presence sensor kit.

F. Optional Space and Presence sensor kit:
   1. The space and presence sensor shall be color matched to the decoration panel.
   2. The sensor kit shall be capable of sensing occupancy within the space and automatically controlling the indoor unit set point in response to the detection of occupancy.
   3. The sensor kit shall be capable of automatically adjusting the direction of individual air discharge outlet louvers in response to the detection of occupants in the vicinity of the unit.
   4. The sensor kit shall be capable of automatically adjusting the direction of individual air discharge outlet louvers in response to the sensed floor temperature.

G. Fan:

1. The fan shall be driven by a direct-drive DC motor with statically and dynamically balanced impeller and shall have three user-selectable speeds available: high, medium, and low. The power input required at the three field selectable speeds shall be made available as standard.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output of 50W.
3. The airflow rate shall be available in high, medium, and low settings.
4. When FXZA-AAVJU is connected with either the Navigation Remote Controller or the I-Touch Manager/Daikin Hero central controller, the Auto fan mode shall be selectable.

H. Filter:
   1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

I. Coil:
   1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3. The coil shall be a 2-row cross fin copper evaporator coil with 22 FPI design completely factory tested.
   4. The refrigerant connections shall be flare connections and the condensate will be 1 -1/32 inch outside diameter PVC.
   5. A condensate pan shall be located under the coil.
   6. A condensate pump with a 24-13/16” lift, measured from the drain outlet, shall be located below the coil in the condensate pan with a built-in safety alarm.
   7. A thermistor will be located on the liquid and gas line.

J. Electrical:
   1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
   2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

K. Control:
   1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
   2. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

Part 5 - HVAC EQUIPMENT ALTERNATE (GENERAL INFORMATION)

5.01 The alternate equipment supplier shall provide to the bidding mechanical contractor a complete equipment data package. This package shall include, but is not limited to, equipment capacities at the design condition, power requirements, indoor units CFM/static pressures, fan curves, installation requirements, and physical dimensions. Nominal performance data is not acceptable.

The mechanical contractor shall request and receive the equipment data package 15 days prior to bid date and submit this package with the alternate bid.

The mechanical contractor shall list the equipment supplier and submit the required data package with the bid detailing a complete comparison of the proposed alternate equipment to the specified equipment and the associated cost reduction of the alternate equipment. The contractor bids an alternate manufacturer with full knowledge that that manufacture’s product may not be acceptable or approved.

5.02 The alternate equipment supplier shall furnish a complete drawing package to the mechanical contractor 15 days prior to bid day for bidding and installation. The drawing format shall be .dxf or equivalent, on 30"x42" sheets. The HVAC and electrical series design documents will be made available in electronic format for use by the equipment supplier in preparing their drawings. The alternate equipment supplier shall prepare the following drawings:

XXX HVAC Floor Plan
XXX HVAC Refrigerant Piping Plan

XXX HVAC Refrigerant Piping/Controls Details

XXX HVAC Details

XXX HVAC Schedules

The alternate equipment supplier shall draft all piping circuits, components, overall building control schematic, detailed control wiring diagrams, system details, and schedules for their system. The drawings shall convey all requirements to successfully install the alternate equipment supplier's system.

Provide (2) drawing package sets plotted on 20 lb. vellum. Provide (1) drawing package in electronic format (dxf files) on CD.

The submitted documents shall be complete system designs and show no less information than the HVAC equipment/controls contract bid documents.

5.03 The equipment supplier shall submit as part of the equipment data package outdoor unit data sheets. Data sheets to include the following:

Capacities at project design conditions: Cooling

Cooling (Btu/h)

Cooling Input Power

(kW)

Capacities at project design conditions: Heating

Heating (Btu/h)

Heating Input Power

(kW)

The submitted capacity and efficiency performance must meet or exceed the listed performance on the schedule at the designed outdoor ambient,

and indoor space temperature conditions including de-rate factors for defrost and refrigerant piping lengths.

Operating Temperature Range:

Cooling

Heating

Power Supply:

Maximum Circuit Amps (MCA)

Maximum Overcurrent Protection Amps (MOP)

Maximum Starting Current (MSC)

Outdoor Fan Motor

Refrigerant:

Refrigerant Type/Charge

Control

Unit Data:

Max. Number of Indoor Units

Sound Pressure Level at 3ft. (dBA)

Weight (lbs)

Dimensions

5.04 The equipment supplier shall guarantee the performance of their system and all published data submitted. Performance shall be based on the design criteria below.

Room Temperature (Cooling): _____

Room Temperature (Heating): _____

Ambient Temperature (Summer): _____

Ambient Temperature (Winter): _____

Defrost De-rate Factor: _____

Refrigerant Piping Loss in cooling (correction factor): _____

Refrigerant Piping Loss in heating (correction factor): _____

5.05 The alternate equipment supplier shall submit with bid, indoor unit data sheets. Data sheets to include the following:

Capacities:

Cooling (Btu/h)

Heating (Btu/h)

Air Flow (CFM)

External Static Pressure (ESP)

Electrical Data (MCA, MOP, MSC)

Weight (lbs)

Dimensions

1. VRV SYSTEM BRANCH SELECTOR UNITS
   A. Design Basis:
      1. The HVAC equipment Basis of Design is Daikin.
      2. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Key General Specifications Alternate Supplier Checklist). In any event the contractor shall be responsible for all specified items and intents of this document without further compensation.

3. Any efforts to bid with alternate manufactures shall ensure compliance with all sections of this specification.

B. GENERAL:

1. SINGLE-PORT BRANCH SELECTOR BOX
   a. The BSA36AAVJ, BSA60AAVJ, and BSA96AAVJ, are designed specifically for use with R32 VRV EMERION, R32 VRV AURORA, and R32 Water Cooled heat recovery system components.
   b. The single port branch selector boxes BSA_A shall provide individual control and changeover for one group of indoor units.
   c. These BSA_A branch controllers shall support low ambient cooling down to −4F° to connected indoor units.
   d. These selector boxes shall be factory assembled, wired, and piped.
   e. These branch selector boxes shall have a heat-by-pass control loop inside the units to prevent overheating of space during heating cycles
   f. These selector boxes must be mounted indoors.
   g. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.

2. MULTI-PORT FLEX BRANCH SELECTOR BOX SERIES
   a. The BSF4A54AAVJ, BSF6A54AAVJ, and BSF8A54AAVJ are designed specifically for use with R32 VRV EMERION, R32 VRV AURORA, and R32 Water Cooled heat recovery system components.
   b. These branch selector boxes shall provide individual control and changeover for multiple groups of indoor units.
   c. These branch selector boxes shall allow for Field selectable LEFT/RIGHT/PASS THROUGH piping configuration.
   d. These branch selector boxes shall allow multiple branch selector boxes to be connected downstream of the first Branch selector box in series.
   e. These Branch selector boxes, when connected in series, shall be able to support a total indoor load of up to 230MBH.
   f. The EEV heads and motors used in the branch selector box shall be accessible via a quick access panel without disassembly of the electrical box.
   g. The electrical box of the 4-port branch selector box shall be field re-locatable to left, right, and back side of the main cabinet.
   h. These branch selector boxes shall allow connected indoor units to operate in cooling mode down to -4F without any additional field installed accessories
   i. Labels shall be displayed close to the incoming 3 pipes to facilitate clear identification and eliminate cross piping.
   j. The branch selector boxes shall employ EEV with the ability to control up to 6000 pulses
   k. These selector boxes shall be factory assembled, wired, and piped.
   l. These selector boxes must be mounted indoors.
   m. When simultaneously heating and cooling, the units in heating mode shall energize their sub cooling electronic expansion valve.

3. The number of connectable indoor units shall be in accordance with the table below:

BRANCH SELECTOR TYPE	MODEL NUMBER	MAXIMUM CONNECTABLE COOLING CAPACITY	MAXIMUM NUMBER OF CONNECTABLE INDOOR UNITS PER BRANCH
SINGLE-PORT	BSA36AAVJ	36,000 Btu/h	4
	BSA60AAVJ	60,000 Btu/h	8
	BSA96AAVJ	96,000 Btu/h	8
MULTI-PORT FLEX-SERIES	BSF4A54AAVJ	144,000 Btu/h*	5
	BSF6A54AAVJ	216,000 Btu/h*	5
	BSF8A54AAVJ	290,000 Btu/h*	5

* For multiple branch selector box connected in series, refer to the engineering manual for details.

C. UNIT CABINET
1. These units shall have a galvanized steel plate casing.
2. Each cabinet shall house 3 electronic expansion valves for refrigerant control per branch as well as shut off valves for refrigerant mitigation.
3. The cabinet shall contain one subcooling heat exchanger per branch.
4. The unit shall have sound absorption thermal insulation material made of flame- and heat-resistant foamed polyethylene.
5. Nominal sound pressure levels shall be measured and published in the submittals by the manufacturer. The sound levels must not exceed the values below.
   a. If an alternative manufacturer is selected, the mechanical contractor shall provide, at their own cost and expense, any additional material and labor to meet the below published sound levels

BRANCH SELECTOR TYPE	MODEL NUMBER	SOUND LEVEL dB(A) OPERATION	SOUND LEVEL dB(A) MAX
SINGLE PORT	BSA36AAVJ	35	40
	BSA60AAVJ	41	45
	BSA96AAVJ	41	45
MULTI-PORT FLEX-SERIES	BSF4A54AAVJ	36	43
	BSF6A54AAVJ	37.5	46
	BSF8A54AAVJ	37.5	46

DIMENSIONS:

b. The branch selector units shall not exceed the dimensions stated in the table below.

BRANCH SELECTOR TYPE	MODEL NUMBER	HEIGHT Inches (mm)	WIDTH Inches (mm)	DEPTH Inches (mm)
SINGLE PORT	BSA36AAVJ	8-1/8 (207)	15-1/4 (388)	16-3/4 (426)
	BSA60AAVJ	8-1/8 (207)	15-1/4 (388)	16-3/4 (426)

	BSA96AAVJ	8-1/8 (207)	15-1/4 (388)	16-3/4 (426)
MULTI-PORT FLEX-SERIES	BSF4A54AAVJ	9 -1/2 (241)	19-15/16 (490)	28-3/16 (716)
	BSF6A54AAVJ	9 -1/2 (241)	33-7/16 (849)	28-3/16 (716)
	BSF8A54AAVJ	9 -1/2 (241)	33-7/16 (849)	28-3/16 (716)

6. REFRIGERANT VALVES:
   a. The unit shall be furnished with 3 electronic expansion valves per branch to control the direction of refrigerant flow. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.
   b. The refrigerant connections must be of the braze type.
   c. In multi-port units, each port shall have its own electronic expansion valves. If common expansion/solenoid valves are used, redundancy must be provided.
   d. Multiple indoor units may be connected to a branch selector box with the use of a REFNET™ joint provided they are within the capacity range of the branch selector.
   e. These branch selector boxes shall support up to the maximum capacity per port shown in the table below

BRANCH SELECTOR TYPE	MODEL NUMBER	MAXIMUM CAPACITY PER PORT
SINGLE PORT	BSA36AAVJ	36,000 Btu/h
	BSA60AAVJ	60,000 Btu/h
	BSA96AAVJ	96,000 Btu/h
MULTI-PORT FLEX-SERIES	BSF4A54AAVJ	54,000 Btu/h
	BSF6A54AAVJ	54,000 Btu/h
	BSF8A54AAVJ	54,000 Btu/h

7. CONDENSATE REMOVAL:
   a. The unit shall be hermetically sealed to prevent condensation build up inside the unit and not require use of a secondary condensate collection pan. A safety device or secondary drain pan shall be installed by the mechanical contractor to comply with the applicable mechanical code if an alternate manufacturer is selected.

8. INTEGRATED SAFETY SHUT OFF VALVES:
   a. The branch selector box shall have valves that close to limit the releasable charge in the event of a leak detection.
   b. The safety shut off valves shall close in the event that the indoor unit detects a leak.

9. VENTILATED ENCLOSURE OPTION
   a. The branch selector box shall be compatible with the ventilated branch box enclosures which can be assembled around the boxes and ventilated to a larger space or to the exterior. See applicable models on the table below.

Enclosure Model	Applicable Branch Selector Model
BS-EBF04-AA	BSF4A54AAVJ
BS-EBF07-AA	BSF6A54AAVJ
	BSF8A54AAVJ
BS-EBSVA-AA	BSA36AAVJ
	BSA60AAVJ
	BSA96AAVJ

b. The enclosure shall have a leak sensor which once triggered, closes the valves and the system.

10. ELECTRICAL:
    a. The unit electrical power shall be 230 volts, 1 phase, 60 hertz.
    b. The unit shall be capable of operation within the limits of 187 volts to 255 volts.
    c. The minimum circuit amps (MCA) shall be 0.1, and the maximum overcurrent protection amps (MOP) shall be 15.
    d. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded 2 conductor cable.

2. HEAT PUMP SAFETY SHUT OFF VALVE BOXES

A. GENERAL:
   a. The SVA60AAVJ and SVA96AAVJ are designed specifically for use with R32 VRV EMERION, R32 VRV AURORA, and R32 Water Cooled heat pump system components.
   b. These boxes shall be factory assembled, wired, and piped.
   c. These boxes must be mounted indoors.
   d. The number of connectable indoor units shall be in accordance with the table below:

SAFETY SHUT OFF VALVE TYPE	MODEL NUMBER	MAXIMUM CONNECTABLE COOLING CAPACITY	MAXIMUM NUMBER OF CONNECTABLE INDOOR UNITS PER BRANCH
SINGLE-PORT	SVA60AAVJ	60,000 Btu/h	16
	SVA96AAVJ	96,000 Btu/h	16

B. UNIT CABINET
   1. These units shall have a galvanized steel plate casing.
   2. Each cabinet shall house 2 electronic expansion valves to limit releasable charge.
   3. The cabinet shall contain one subcooling heat exchanger per branch.
   4. The unit shall have sound absorption thermal insulation material made of flame- and heat-resistant foamed polyethylene.
   5. Nominal sound pressure levels shall be measured and published in the submittals by the manufacturer. The sound levels must not exceed the values below.
      a. If an alternative manufacturer is selected, the mechanical contractor shall provide, at their own cost and expense, any additional material and labor to meet the below published sound levels

SAFETY SHUT OFF VALVE TYPE	MODEL NUMBER	SOUND LEVEL dB(A) OPERATION	SOUND LEVEL dB(A) MAX
SINGLE PORT	SVA60AAVJ	35	40
	SVA96AAVJ	41	45

DIMENSIONS:

b. The branch selector units shall not exceed the dimensions stated in the table below.

SAFETY SHUT OFF VALVE TYPE	MODEL NUMBER	HEIGHT Inches (mm)	WIDTH Inches (mm)	DEPTH Inches (mm)
SINGLE PORT	SVA60AAVJ	8-1/8 (207)	15-1/4 (388)	16-3/4 (426)
	SVA96AAVJ	8-1/8 (207)	15-1/4 (388)	16-3/4 (426)

6. REFRIGERANT VALVES:
   a. The refrigerant connections must be of the braze type.
   b. The safety shut off valve box shall have valves that close to limit the releasable charge in the event of a leak detection.
   c. The safety shut off valves shall close in the event that the indoor unit detects a leak.
   d. These safety shut off valves shall support up to the maximum capacity per port shown in the table below

BRANCH SELECTOR TYPE	MODEL NUMBER	MAXIMUM CAPACITY PER PORT
SINGLE PORT	SVA60AAVJ	60,000 Btu/h
	SVA96AAVJ	96,000 Btu/h

7. CONDENSATE REMOVAL:
   a. The unit shall be hermetically sealed to prevent condensation build up inside the unit and not require use of a secondary condensate collection pan. A safety device or secondary drain pan shall be installed by the mechanical contractor to comply with the applicable mechanical code if an alternate manufacturer is selected.

8. VENTILATED ENCLOSURE OPTION
   a. The valve box shall be compatible with the ventilated branch box enclosures which can be assembled around the boxes and ventilated to a larger space or to the exterior. See applicable models on the table below.

Enclosure Model	Applicable Safety Shut Off Valve Model
BS-EBSVA-AA	SVA60AAVJ
	SVA96AAVJ

   b. The enclosure shall have a leak sensor which once triggered, closes the valves and the system.

9. ELECTRICAL:

a. The unit electrical power shall be 230 volts, 1 phase, 60 hertz.
b. The unit shall be capable of operation within the limits of 187 volts to 255 volts.
c. The minimum circuit amps (MCA) shall be 0.1, and the maximum overcurrent protection amps (MOP) shall be 15.
d. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded 2 conductor cable.

END OF SECTION

SECTION 260000 – ELECTRICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

A. The Requirements of General Conditions and Special Conditions apply to Work of this Section as if fully repeated herein.

1.2 WORK INCLUDED

A. Provide a complete working installation with all material and equipment as shown and specified.

B. Provide submittals and shop drawings.

C. Make electrical connections for equipment furnished as part of Work of other Sections.

D. Include sealing and fireproofing of conduits and cables.

E. Provide as-built drawings.

1.3 QUALITY ASSURANCES

A. Requirements of Regulatory Agencies:
   1. Nothing in the Contract Documents shall be construed to permit Work not conforming to applicable codes, laws, ordinances, rules or regulations.
   2. All installed or connected equipment shall be labeled or certified for its use by a nationally recognized testing laboratory.
   3. All materials and equipment shall be installed in accordance with manufacturer's recommendations and in accordance with the National Electrical Contractors Association (NECA) Standard of Installation.

1.4 PERMITS, FEES AND INSPECTIONS

A. Contractor shall obtain all permits and arrange for Owner to pay required fees to any governmental agency or utility company having jurisdiction over the work of this Section. Inspections required by any local ordinances or utility companies during construction shall be arranged by the Contractor.

B. All work and materials covered by these specifications and accompanying drawings shall at all times be subject to inspection by the Architect or his representative. Any material not in accordance with the plans and specifications, or not installed in a neat and workmanlike manner, shall, upon order from the Architect, be removed from the premises or corrective action taken within three (3) days; and if material in question has been installed, the entire expense for removing and reinstalling shall be borne by the Contractor.

C. On completion of the work, satisfactory evidence shall be furnished to the Architect to show that all work has been installed in accordance with the Codes.

1.5 SPECIFICATIONS AND CONTRACT DRAWINGS

A. Accuracy of data given herein and on the drawings is as exact as could be secured, but their extreme accuracy is not guaranteed. The drawings and specifications are for the assistance and guidance of the Contractor and exact locations, distances, levels, etc., will be governed by the construction and the Contractor shall accept same with this understanding.

B. Layouts of equipment, accessories and wiring systems are diagrammatic (not pictorial and not exact), but shall be followed as closely as possible. Architectural, structural, mechanical, and other drawings shall be examined noting all conditions that may affect this work. Where connections to equipment provided by other divisions are shown on electrical drawings, refer to drawings of respective division for exact locations and electrical requirements of equipment.

C. Report conflicting conditions to the Architect for adjustment before proceeding with work. Should Contractor proceed with work without reporting conflict(s), he does so on his own responsibility, and shall alter work if directed by the Architect, at his own expense.

D. Right is reserved to make minor changes in locations of equipment and wiring systems shown, providing change is ordered before conduit runs and/or work directly connected to same Is Installed and no extra materials are required.

E. Drawings and specifications may be superseded by later detail specification and detail drawings prepared by the Architect, and the Contractor shall conform to them and to such reasonable changes in the contract drawings as may be called for by these revised drawings without extra cost to the Owner.

F. Contractor may request additional detail(s) and such shall be conformed to, without additional cost. Contractor may offer alternate detail(s), but such detail(s) shall be approved by Architect and authority having jurisdiction

1.6 SUBMITTALS

A. Submission Requirements
   1. Contractor is responsible for the scheduling of submittals in order to avoid detrimental impact to the construction schedule and to support the timely sequence of the Work. Allow a minimum of 15-working days for submittal review by the Engineer. Complex submittals or submittals which are not provided as complete packages may take longer than 15-working days for review. Contractor should allow time for potential rejection and re-submittal of submittals which are being offered as substitution to the specified products.
   2. Contractor shall review submittals for completeness, coordination and conflicts between subcontractors and other work in the Contract Documents. Submittals made by Contractor which are not thoroughly reviewed by the Contractor will be returned. Submittals which vary significantly from the Contract Documents and are not so identified prior to submission, will be returned to the Contractor without review.
   3. Make submissions within following number of days from issuance of Notice to Proceed or Start Letter
      a. Items needed in initial stages of Work or requiring long lead-time for ordering: 15 calendar days.
      b. All other items: 21 calendar days.

4. Before submitting a shop drawing or any related material, Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of the Contractor; approve each such submission before submitting it; and stamp each such submission before submitting it. Engineer shall assume that no shop drawing or related submittal comprises a variation unless the Contractor advises the Engineer otherwise via a written instrument which is acknowledged by the Engineer in writing.
5. Engineer will check submittals for conformance with design concepts of project. Approval covers only such conformance. Effort will be made by Engineer to discover any errors, but responsibility for accuracy and correctness of all submittals shall be with the Contractor.
6. Approval of submittals will be on a general basis only and shall not relieve the Contractor from their responsibility for proper fitting and construction of the Work, nor from furnishing materials and labor required by the Contract which may not be indicated on the submittals when approved.
7. No portion of the work requiring submittals shall be commenced until the submittal for that portion of the work has been approved by Engineer. All such portions of work shall be in accordance with the approved submittal. Any work performed without approved submittals will be done so at the Contractor's own risk. Work found not to be in compliance with the approved submittals shall be removed and corrected at the Contractor's own expense.
8. Number of Copies Required - Contractor shall submit following number of copies:
    a. Shop Drawings: 1-electronic copy in PDF format.
    b. Product Data/Material Lists: 1-electronic copy in PDF format.
    c. Samples: As specifically indicated in pertinent specification section.
    d. Substitution Request: 1-copy in PDF format
9. Submittals shall include (where applicable):
    a. Date and revision dates.
    b. Project title and number.
    c. The names of Architect, Engineer, Contractor, Subcontractor and supplier or manufacturer.
    d. Identification of product or material.
    e. Relation to adjacent structure or material.
    f. Field dimensions, clearly identified as such.
    g. Specification section number.
    h. A blank space for Engineer's stamp.
    i. Contractor's stamp on each, initialed or signed, certifying that submittal was reviewed, field measurements have been verified and submittal is in compliance with the applicable specification section and the overall Contract Documents.
10. Incomplete, inaccurate or non-complying submittals requiring revisions, re-submittal and additional review time, shall not be considered as a basis for Contract time extension.
11. Two reviews will be made for each submittal. Additional reviews will be charged to the Contractor. A rejection of a submittal or review of a partially presented submittal constitutes one submittal review. Incomplete submittals, such as product data submitted without required shop drawings, will be returned without review.

B. Required Submittals
   1. Various specification sections may state additional information to be submitted.
   2. Submittals are required for all equipment and low voltage/control systems even though the submitted material may be exactly as specified in the Project Manual.
   3. Electrical Materials Submittal:
      a. Submit product data only for materials that are being substituted. Product data is not required for materials that are being provided as specified.
      b. Electrical materials include raceway, boxes, supports, finish material, etc.
   4. Electrical Equipment Submittal:
      a. Submit product data for all equipment.
      b. Electrical equipment includes panelboards, switchboards, transformers, underground pullboxes, floor boxes, light fixtures, etc.
   5. Low Voltage and Control Systems Submittals:
      a. Provide product data for each item in the system.
      b. Provide shop drawings for each system.
      c. Low voltage and control systems include lighting controls, sound communications, fire alarm, etc.

C. Product Data
   1. Manufacturer's Standard Schematic Drawings:
      a. Modify drawings to delete information which is not applicable to the Project.
      b. Supplement standard information to provide additional information which is applicable to the Project.
   2. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
      a. Clearly mark each copy to identify pertinent materials, products or models. Mark out or remove all extraneous information.
      b. Show dimensions and clearances required.
      c. Show performance characteristics and capacities.
      d. Show wiring diagrams and controls.

D. Shop Drawings
   1. Submit shop drawings as a copy of the original set maintained by the Contractor. Shop drawings are to include the name of the project, the name of Contractor and are to be numbered consecutively. Provide legible and complete copies in every respect. Provide quantity as described below. Do not reproduce bid document drawings in lieu of Contractor or subcontractor produced shop drawings.
   2. Contract documents define the general scope of work. Contractor’s submittal shall not be a duplication of the contract drawings, but shall be a result of site and system investigation and shall show all the work required. Do not reproduce bid document drawings in lieu of Contractor or subcontractor produced shop drawings.
   3. If shop drawings show variations from Contract requirements because of standard shop practice or other reason, make specific mention of such variations in letter of transmittal, as well as on drawings, in order that (if acceptable) suitable action may be taken for proper

adjustment of the Contract Documents. Unless specific changes have been noted and approved, no deviations from Contract Documents will be accepted.

4. If the shop drawings are accepted or rejected, all reviewed and stamped copies will be distributed to all parties. If corrections are required, the Contractor is responsible for making the necessary corrections and re-submitting the shop drawings in a timely fashion as to not affect the project schedule. The Contractor must secure final acceptance prior to commencing work involved.

E. Substitutions
1. Engineer's Approval Required:
a. Contract is based on materials, equipment and methods described in Contract Documents. Substitutions will not be reviewed and approved prior to the award of the contract.
b. Engineer will consider proposals during the submittal process for substitution of materials, equipment and methods only when such proposals are accompanied by full and complete technical data and all other information required by Engineer to evaluate proposed substitution. Substitution shall be submitted with completed Substitution Request Form.
c. Do not substitute materials, equipment or methods unless such substitution has been specifically approved for this work by Engineer.
2. "Or Equal": Whenever, in Contract Documents, any material, process or specified patent or proprietary name and/or by name of manufacturer is indicated, such name shall be deemed to be used for purpose of facilitating description of material and/or process desired, and shall be deemed to be followed by the words "or equal", or “accepted equal”, and Contractor may offer any material or process which shall be equal in every respect to that so indicated or specified; provided, however, that if material, process or article offered by Contractor is not, in opinion of Architect, equal in every respect to that specified, then Contractor must furnish material, process or article specified or one that in opinion of Engineer is equal thereof in every respect.
3. “No Substitutions”: Items indicated as “No Substitutions” must be provided as specified and no alternates will be allowed. These items are required either due to District standards by the Board or to match materials recently installed by others.
4. Coordination: Approval of substitution shall not relieve Contractor from responsibility for compliance with all requirements of Drawings and Project Manual, and Contractor shall be responsible at his own expense for any changes in other parts of his own work or work of others which may be caused by approved substitution.
5. DSA Approval: Substitutions of certain items may cause such items to require a Deferred Approval by DSA. Should a DSA Deferred Approval be required, the Contractor shall provide all information and documents necessary to complete the Deferred Approval process without any additional costs to the Owner, including engineering, calculation and modification of substitute products.

1.7 OPERATION AND MAINTENANCE MANUALS

A. General: Contractor shall incorporate in Maintenance/Operation Manual(s) all brochures, manufacturer's catalogs and written instructions for equipment and materials needing regular care or maintenance and other items as required elsewhere in project documents. Prepare all such

manuals in durable plastic loose leaf binders size to accommodate 8-1/2 x 11 sheets with following minimum data:

1. Identification on or readable through, front cover stating general nature of manual.
2. Neatly typewritten index of all contents.
3. Site plan and building plans indicating location of equipment referenced (reduced scale).
4. Complete instructions regarding operation, maintenance, replacement instructions and programming instructions of all equipment involved.
5. Complete nomenclature of all replaceable parts, their part numbers, current cost and name and address of nearest vendor of parts.
6. Copy of all guarantees and warranties issued, in a separate binder as specified in this section.
7. Copy of approved shop drawings (reduced scale) with all data concerning changes made during construction.

B. Extraneous Data:
   1. Where contents of manuals include manufacturer's catalog pages, clearly indicate precise items included in the Project installation and delete, or otherwise clearly indicate, all manufacturer's data with which the Project installation is not concerned.

C. Materials shall be organized in a logical and consistent manner, by specification section number, with separating tabs clearly marked.

D. Data shall be provided for:
   1. Panelboards
   2. Switchboards
   3. Transformers
   4. Lighting Fixtures
   5. Lighting Control System
   6. Stage Lighting System
   7. Emergency Lighting System
   8. Sound and Signal Systems
   9. Intrusion Alarm System
   10. Clock System
   11. Fire Alarm System
   12. AV Systems
   13. Telephone System

E. In addition to the requirements above, contractor shall provide final programming information to District on disk for all systems requiring programming.

1.8 RECORD DRAWINGS (AS-BUILTS)

A. At time of installation, installed locations of all underground work shall be recorded on prints by Contractor, and reviewed with Inspector. Record drawings are to be maintained and adjusted on a daily basis by the Contractor.

B. All information entered on drawings copy shall be neat, legible and emphasized by drawing "clouds" around changed items. Changes shall be made in an accurate manner by a qualified draftsperson acceptable to Architect. Completed Record Drawings shall be signed by the Contractor.

C. Locate and dimension all major equipment and underground work, including stubs and pullboxes. Provide dimensions from curbs, foundations, or other permanent landmarks.

D. All symbols and designations used in preparing record drawings shall match those used in the Contract Drawings.

E. Record drawing shall be up-dated monthly.

F. Record drawing signoff:
   1. At such time that the underground work has been completed, all the contractors and sub contractors notes, sketch and miscellaneous drawings documenting installed locations not currently part of the ongoing record drawing set shall be transferred. These updates shall be reviewed for accuracy by the inspector of record and architect. Once all corrections have been completed the inspector shall sign and date the record set coversheet noting it as acceptance of the underground phase of record drawings.
   2. At project completion, the record drawings shall be submitted by the contractor for project inspector and architect review and comment. These will be returned to the contractor for revisions. Once all corrections have been completed the inspector shall sign and date the record set coversheet noting it as acceptance of the completed record drawings. The original record drawings are to be resubmitted to the architect along with a scanned electronic file set in PDF format with file names matching the drawing titles.

1.9 GUARANTEES

A. Standard Guarantee: Provide individual as well as overall guarantees for all work executed under this Contract or any extra work to be absolutely free of all defects of workmanship and materials for a period of two years from the date of filing of notice of completion and acceptance by Owner. Repair and make good all such defects and repair any damage to other work caused thereby which may occur during same period at no cost to the owner.

B. Indicate on Guarantee Form specific provisions required by individual specification sections. List all special requirements, extended periods, bonding, etc.

C. Additional Guarantees: Provide additional guarantees (in excess of year(s) required by Standard Guarantee) where specifically required by pertinent Specification Sections.

D. Binder: Provide a binder with all guarantees placed in the order in which they occur in the project manual. Include an Index of Guarantees listing each specification section, specific items covered and length of guarantee for each item.

1.10 SITE EXAMINATION AND CONDITIONS

A. Examine site; verify dimensions and locations against Drawings and become informed of all conditions under which Work is to be done before submitting proposals.

B. Where signal systems exist, and services of other firms are required, Contractor shall instruct those firms to investigate existing systems and determine labor and materials needed to add devices or modify systems.

C. Where new conduits are to be run underground at existing sites, contractor shall visit site prior to bidding and walk routes of new underground conduits, note areas of concrete and asphalt being crossed, and include in bid all costs for cutting and patching.

D. Where existing conduits are shown, their location is diagrammatic and their exact location may not be known.

E. No allowances shall subsequently be made in Contractor's behalf for any extra expense to which he or his "subs" may be put due to failure or neglect to discover conditions affecting the work.

1.11 UTILITY COMPANY COORDINATION:

A. Immediately after award of contract, Contractor shall contact utility company representatives for power, telephone, and TV services. Contractor shall obtain specific requirements and details from respective representative. Contractor shall discuss the aspects of the project related to services and coordinate scheduling of the work and inspections required by utility companies.

1.12 UNDERGROUND UTILITIES:

A. Existing underground utilities, services, circuits, piping, irrigation piping, etc., are present, but their exact locations are not known. Contractor shall locate and protect before trenching or excavating in any area. Consult utility companies, "as-built drawings" and Owner's maintenance personnel for location of existing underground work. If existing piping or utilities are damaged during construction. Contractor shall repair immediately at own expense. New underground work shall be modified as necessary to conform to existing conditions.

1.13 CLEANING AND CLEANUP

A. After all work has been accomplished such as sanding, painting, etc., lighting fixtures, panelboards, and switchboards shall be cleaned to remove all dust, dirt, grease, paint, or other marks. All electrical equipment shall be left in a clean condition inside and out, satisfactory to the Architect. Keep buildings and premises free from accumulated waste materials, rubbish, and debris resulting from work herein, and, upon completion of said work, remove tools, appliances, surplus materials, waste materials, rubbish, debris, and accessory items used in or resulting from said work and legally dispose of off the site.

1.14 PROTECTION

A. The Contractor shall protect from damage during construction the work and materials of other trades as well as the electrical work and material. Electrical equipment stored and installed on the job site shall be protected from dust, water, or any other damage.

1.15 WORKING SPACE

A. Adequate working space shall be provided around electrical equipment in strict compliance with the Codes. In general, provide 6'6" of headroom and 36" minimum clear work space in front of switchboards, panelboards, transformers, disconnect switches and controls for 120/208 volts and

42" for 277/480 volts. Carefully coordinate locations and orientation of electrical equipment with other divisions to ensure that working space will be clear of piping, conduits, and equipment provided by others.

1.16 COOPERATION AND COORDINATION

A. Cooperate and coordinate with other crafts in putting the installation in place at a time when the space required by this installation is accessible. Work done without regard to other crafts shall be moved at the Contractor's expense.

1.17 INSPECTION

A. The Contractor shall cooperate with the Architect and shall provide assistance at all times for the inspection of the electrical work performed under this contract. He shall remove covers, operate machinery, or perform any reasonable work which, in the opinion of the Engineer, will be necessary to determine the quality and adequacy of the work.

1.18 MANUFACTURER'S DIRECTIONS

A. Follow manufacturer's directions where these directions cover points not included on the drawings or in the specifications. When equipment is provided by other divisions, obtain directions from respective supplier.

1.19 WORKMANSHIP

A. Good workmanship shall be evidenced in the installation of all electrical materials and equipment. Equipment shall be level, plumb and true with the structure and other equipment. All materials shall be firmly secured in place and adequately supported and permanent. The recommendations of the National Electrical Contractors Association Standard of installation shall be followed except where otherwise specifically directed.

1.20 OPERATING TEST

A. After the installation is complete, and at such time as the Engineer and other authorities having jurisdiction may request, the Contractor shall conduct an operating test for approval.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturer's Directions: Follow manufacturer's directions where manufacturers of articles used furnish directions covering points not specified or shown.

B. All Work shall be done in orderly, workmanlike manner and present neat appearing installation when completed.

C. Provide metal backing plates, anchor plates, and similar items that are required for anchorage for the Work of this Section; securely weld or bolt to metal framing. Wood blocking or backing will not be permitted in combination with metal framing.

D. Equipment: Accurately set and level, neatly place support and anchor properly. Anchorage shall conform to the requirements of California Building Code. No allowance will be made for negligence to foresee means of placing, installing or supporting equipment in position.

E. Electrical products shall be anchored and fastened to building elements and finishes as follows:
   1. Concrete Structural Elements: Provide expansion anchors and powder actuated anchors.
   2. Steel Structural Elements: Provide beam clamps and spring steel clips.
   3. Concrete Surfaces: Provide expansion anchors.
   4. Solid Masonry Walls: Provide expansion anchors.
   5. Sheet Metal: Provide sheet metal screws.
   6. Wood Elements: Provide wood screws.

F. All wiring shall be installed in conduit, unless specifically shown otherwise on plans.

3.2 TESTING AND ADJUSTING

A. Furnish all labor and test equipment required for the Work of this Division. Testing work is defined as that work necessary to establish that equipment has been properly assembled, connected, and checked to verify that intent and purpose of Drawings, manufacturer's instruction manuals, and directions of Architect have been accomplished in satisfactory manner.

B. Test each individual circuit at panel with equipment connected for proper operation.

C. Test each individual receptacle device for proper polarity and grounding.

D. Test each ground fault circuit interrupter for proper operation.

END OF SECTION 260000

SECTION 260505 – SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.
2. Disposal of materials.
3. Storage of removed materials.
4. Identification of utilities.
5. Salvaged items.
6. Protection of items to remain as indicated on Drawings.
7. Relocate existing equipment to accommodate construction.

1.2 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of capped utilities, conduits, and equipment abandoned in place.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with State, Municipality, Highways, and Public Work's standard.

1.4 SCHEDULING

A. Schedule work to coincide with new construction.

B. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.5 COORDINATION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Coordinate demolition work with Owner’s representative and all other disciplines.

C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

D. Shut-down Periods:
1. Arrange timing of shut-down periods of in service panels with Owner’s representative. Do not shut down any utility without prior written approval.
2. Keep shut-down period to minimum or use intermittent period as directed by Owner’s representative.

3. Maintain life-safety systems in full operation in occupied facilities, or provide notice minimum 72 hours in advance.

E. Identify salvage items in cooperation with Owner.

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

B. Verify termination points for demolished services.

C. Verify extent of demolition work required. Drawings show the general demolition scope and may not show all required work.

3.2 PREPARATION

A. Take care to ensure that there will be no damage to structural elements or portions there-of-which are not to be removed. Erect and maintain temporary shoring, bracing, and other means to safeguard the structural integrity of the existing buildings and structures.

B. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

C. Protect existing structures, facilities, and plant life from damage. Items damaged because of demolition operations shall be repaired or replaced, at no cost to the Owner.

D. Interruption of Service:
1. Services (power, telephone, fire alarm and other signal services) to existing building(s) and their related circuits which are to remain in operation shall not be interrupted except by specific approval of the Owner.
2. Make temporary connections to maintain service in areas adjacent to work area.
3. If it is deemed necessary to shut down circuits for the installation of new work, such shut down shall be scheduled with the Owner who may, at his option, have a representative present.
4. Any accidental interruption of service to circuits or equipment as a result of work performed by the Contractor shall, at the Contractor's expense, be restored in a manner acceptable to the Owner.
5. Fire Alarm and Intrusion Alarm Systems:
a. Fire alarm system must be kept operational during work of this contract. If operation of existing system or portion of existing system is disrupted for connections into system or cutoff for any reason by work of this project, Contractor must provide fire

watch. Fire watch must occur 24-hours per day and every day system is down. Fire watch proposed by Contractor must be acceptable to local fire authority and Owner. All costs for fire watch shall be Contractor's responsibility.

b. Intrusion alarm system must be kept operational during unoccupied hours. In the event that the system or portion of system in nonoperational during off-hour periods as a result of work of this contract, the Contractor must provide guard(s) to patrol the campus. Guard(s) and guard duties proposed by Contractor must be acceptable to District and District Police (local enforcement if District does not have its own Police Services). All costs for security guard(s) shall be Contractor's responsibility.

3.3 DEMOLITION

A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner or Architect/Engineer before disturbing existing installation.

B. Completely remove items shown to be removed on plans. Remove all associated raceways, supports, boxes, wiring, etc.

C. When walls or ceilings are opened up during construction, remove any abandoned raceways, boxes, supports, wiring, etc.

D. Cut conduit flush with walls and floors, and patch surfaces.

E. Where devices are removed and flush outlet box is to remain, provide blank cover plates.

F. Where removal of a device cuts off circuits to devices that are to remain, make connections as required to maintain the existing circuits.

G. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

H. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit and wiring servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

I. Disconnect and remove abandoned panelboards and distribution equipment.

J. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

K. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

L. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

M. Remaining Circuits and Equipment: Reinstall existing electrical installations disturbed. Certain existing electrical installations may be in walls, ceilings or floors that are to be removed and are essential for the operation of other remaining installations. Where this condition occurs provide a new extension of original circuits, raceways, equipment and outlets to retain service continuity. Installations shall be concealed in finished areas.

N. Reconnect equipment being disturbed by renovation work and required for continue service to or nearest available panel.

O. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.

P. Install temporary wiring and connections to maintain existing systems in service during construction.

Q. Perform work on energized equipment or circuits with experienced and trained personnel.

R. Remove, relocate, and extend existing installations to accommodate new construction.

S. Repair adjacent construction and finishes damaged during demolition and extension work.

T. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.

U. Clean and repair existing equipment to remain or to be reinstalled.

V. Protect and retain power to existing active equipment remaining.

W. Cap abandoned empty conduit at both ends.

X. Jack-hammering
   1. Jack-hammering will be permitted only to a limited degree, and only with the prior written approval of the Owner.
   2. Do not jack-hammer within 2-inches of reinforcing or structural steel to remain; remove final 2-inches of material with chipping gun.

3.4 EXISTING PANELBOARDS

A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.

B. Tag unused circuits as spare.

C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.

D. Remove existing wire no longer in use from panel to equipment.

E. Provide new updated directories where more than three circuits have been modified or rewired.

3.5 SALVAGE ITEMS

A. Remove and protect items indicated on Drawings to be salvaged and turn over to Owner.

B. Items of salvageable value may be removed as work progresses. Transport salvaged items from site as they are removed.

3.6 REUSABLE ELECTRICAL EQUIPMENT

A. Carefully remove equipment, materials, or fixtures which are to be reused.

B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

3.7 CUTTING AND PATCHING

A. Make new openings neat, as close as possible to profiles indicated, and only to extent necessary for new work.

B. Do not cut or alter structural members unless specifically indicated or approved, and do not damage reinforcing or structural steel to remain.

C. At concrete, masonry, paving, and other materials where edges of cuts and holes will remain exposed in the completed work, make cuts using power-sawing and coring equipment. Do not over cut at corners of cut openings – saw overruns will not be permitted. Core hole at corner of proposed openings to insert blade and chip square.

D. Upon completion of cutting and coring, clean remaining surfaces of loose particles and dust.

E. Repair and patch all holes and openings from the removed electrical equipment, outlet boxes, etc. Coordinate with the General Contractor and the Architect to include and provide finished to match adjacent area.

3.8 CLEANING

A. Remove demolished materials as work progresses. Legally dispose.

B. Keep workplace neat.

C. Clean surfaces on which new materials will be applied, removing adhesives, bitumen, and other adhering materials, as necessary to furnish acceptable substrates for new materials.

D. Perform sandblasting, chipping, grinding, acid washing, etching, and other work as required by conditions encountered and new materials involved

E. Use of acids or other cleaning agents shall include neutralizing, washing, rinsing, and drying, as applicable.

F. Determine substrate requirements for reconditions surfaces in cooperation with the manufacturer’s representative and installer of each new installer involved.

G. Clean surfaces on which new materials will be applied, removing adhesives, bitumen, and other adhering materials, as necessary to furnish acceptable substrates for new materials.

3.9 PROTECTION OF FINISHED WORK

A. Do not permit traffic over unprotected floor surface.

END OF SECTION 260505

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building wire and cable, wiring connectors and connections.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code with California Amendments.
   2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:
   1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. All wiring shall be copper.
   2. All wiring shall be installed in raceway.
   3. Solid conductor for feeders and branch circuits 10 AWG and smaller.
   4. Stranded conductors for control circuits.
   5. Conductor not smaller than 12 AWG for power and lighting circuits.
   6. Conductor not smaller than 14 AWG for control circuits.
   7. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
   8. 10 AWG conductors for 20 ampere or larger as designated on plans for 120 volt branch circuit home runs longer than 75 feet.
   9. 10 AWG conductors for 20 ampere or larger as designated on plans for 277 volt branch circuit home runs longer than 200 feet.

B. Wiring Methods: Provide the following wiring methods:
   1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN-2 insulation, in raceway.
   2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN-2 insulation, in raceway.
   3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN-2 insulation, in raceway.

4. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN-2 insulation, in raceway.
5. Exterior Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
6. Underground Locations: Use only building wire, Type XHHW-2 insulation, in raceway.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper.

1.5 SUBMITTALS

A. Refer to 26 0000.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet when tested in accordance with NFPA 262.

B. Perform Work in accordance with State, Municipality, Highways, and Public Work's standard.

C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.9 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

B. Wire and cable routing indicated is approximate unless dimensioned.

C. Determine required separation between wire, cable and other work. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Product Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90 degrees C.

E. Insulation Material: Thermoplastic.

2.2 PHOTOVOLTAIC SINGLE – CONDCUTOR CABLE

A. Conductor: Copper.

B. Insulation Voltage Rating 600V.

C. Insulation Type PV or USE-2.

2.3 PLASTIC TAPE:

A. Black 7 mil thick general purpose electrical tape, Scotch 33 plus or equal.

2.4 INSULATING RESIN:

A. Use two part liquid epoxy resin with resin and catalyst in premeasured, sealed mixing pouch. Scotchcast 4 or equivalent.

2.5 REDUCING ADAPTERS:

A. Burndy, Thomas and Betts or approved equal.

2.6 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

2.7 Splices:

A. #10 and smaller, including fixture taps - pre-insulated coiled-spring type connectors, 3M Scotchloks, T&B Piggys, or equal.

B. #8 to #4, Split bolt service connectors, T&B locktite, Burndy Servit, or equal, insulated with Scotch #88, Okoweld four purpose tape, or equal.

C. #2 and larger, bolted pressure connectors, OZ ST, Burndy OKLIP, or equal, insulated with "Scotchfill" and Scotch #88 or Okoweld four purpose tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify interior of building has been protected from weather.

B. Verify mechanical work likely to damage wire and cable has been completed.

C. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods as specified.

E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.4 INSTALLATION

A. Route wire and cable to meet Project conditions.
1. Wire and cable routing indicated is approximate unless dimensioned.
2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
3. Include wire and cable of lengths required to install connected devices within 10 ft. of location shown.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:
1. Pull conductors into raceway at same time.
2. Install building wire 4 AWG and larger with pulling equipment.
3. Use suitable cable fittings and connectors.

E. Special Techniques - Wiring Connections:
1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
4. Install bolted pressure connectors for copper conductor splices and taps, 2 AWG and larger.
5. Install split bolt connectors with for copper conductor splices and taps, 8 AWG to 4 AWG.

6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
7. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
8. Encapsulate below grade splices at outlet, pull and junction boxes with specified insulating resin kits. Make all splices watertight.
9. Install waterproof wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller in outdoor or wet locations.
10. Where oversized cables are used to accommodate voltage drop, whether a single or parallel feeder, provide appropriate reducing adapter and conductors for termination.

F. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

G. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.

H. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

I. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.5 WIRE COLOR

A. General:
1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
   a. Black, red, and blue for circuits at 120/208 volts single or three phase.
   b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
   a. Black, red, and blue for circuits at 120/208 volts single or three phase.
   b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
1. For 6 AWG and smaller: Green.
2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.6 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2.

END OF SECTION 260519

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code, with California Amendments.
2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
1. Metal underground water pipe.
2. Metal building frame.
3. Concrete-encased electrode.
4. Ground ring.
5. Rod electrode.
6. Plate electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms maximum.

1.5 SUBMITTALS

A. Product Data: Submit data on grounding electrodes and connections.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and grounding electrodes.

B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Perform Work in accordance with State, Municipality, Highways, and Public Work's standard.

C. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

A. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Product Description:
   1. Material: Copper.
   2. Diameter: 0.75 inch.
   3. Length: 10 feet.

B. Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 4/0 AWG or as indicated on drawings.

C. Grounding Electrode Conductor: Copper conductor insulated.

D. Bonding Conductor: Copper conductor insulated.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches by 24 inches long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.4 MECHANICAL CONNECTORS

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.5 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods as specified.

3.4 INSTALLATION

A. Install in accordance with IEEE 142 and 1100.

B. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service

equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

C. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

D. Each building shall have its own grounding electrode. Metal water and gas piping, and building structural steel, shall be bonded to grounding electrode at first panel ground bus unless detailed otherwise on the Drawings.

E. Unless detailed otherwise on drawings, grounding electrode(s) shall be foundation ground grid(s) consisting of two opposing runs of 25' lengths of #4/0 soft drawn bare copper conductors installed at bottom of foundation with 2" of concrete between conductors and earth, encased in concrete their entire length exclusive of tails for connections to equipment. Keep conductors separated from reinforcing steel by use of insulating tape. Conductors shall be interconnected by the Cadweld process using molds and charges according to manufacturer's recommendations. Tails for connection to equipment where shown or called for on drawings shall provide not less than 24" length above finished floor level. Protect all tails against damage.

F. Grounding electrodes and connections to building water and gas mains or building structural steel shall have insulated conductors run in conduit directly to service ground bus separate from any other grounding conductor.

G. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

H. Install grounding and bonding conductors concealed from view.

I. Provide grounding bar in electrical room, closet, etc. for grounding of low voltage (LV) equipment, racks and the like. Refer to drawings for detail. Locate grounding bar adjacent to data communication rack.

J. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

K. Bond together metal siding not attached to grounded structure; bond to ground.

L. Bond together reinforcing steel and metal accessories in pool and fountain structures.

M. Install ground grid under access floors. Construct grid of 4 AWG bare copper wire installed on 24 inch centers both ways. Bond each access floor pedestal to grid.

N. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Install 2 AWG bare copper bonding conductor.

O. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

P. All grounding type receptacles shall have grounding contact connected to a grounding conductor. Grounding conductor may be code size green insulated copper conductor installed in circuit raceway or may be metallic raceway. If metallic raceway is used as grounding conductor, a green insulated copper conductor must connect receptacle grounding contact to lug or screw terminal in outlet box or to grounding bushing at raceway. Isolated grounding type receptacles shall have code sized green insulated copper conductor installed in circuit raceway.

Q. Connect to site grounding system.

R. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

S. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.

T. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

U. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground resistance testing in accordance with IEEE 142.

D. Perform leakage current tests in accordance with NFPA 99.

E. Perform continuity testing in accordance with IEEE 142.

F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

3.6 INDEPENDENT TESTING ORGANIZATION AND PERSONNEL

A. Obtain the services of an independent third-party testing organization to perform electrical tests.

B. Independent testing organization and personnel shall meet the requirements of NETA ATS 3.1 and 3.2.

C. Tests shall be performed using a Megger Earth Tester or equivalent.

D. Provide written test results and a final report of electrical tests per NETA ATS 5.4 to Engineer.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Conduit supports (refer to plans for specific details).
2. Formed steel channel (refer to plans for specific details).
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

1.2 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved by Factory Mutual Research for Property Conservation.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code with California Amendments.

D. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479, to achieve fire ratings of adjacent construction in accordance with FM and UL Design Numbers noted on Drawings.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code, FM, and UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

B. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

E. Submit details and calculations for support and anchors that are not specifically detailed on the Drawings where required by California Building Standards Code, California Code of Regulations, Title 24. Pre-approved systems may be used as noted below only if the pre-approval is current and accepted by the local agency having jurisdiction.

F. Where pre-approved bracing systems will be employed, submit:
1. System component brochure describing components used and detailed installation instructions.
2. Loads to be transmitted to the structure at anchor points.

G. Where pre-approved bracing systems are not used, submit details and calculations of proposed systems. Include:
1. Detailed drawings and calculations showing system to be installed, stamped by a Structural Engineer registered in the state of California.
2. Loads to be transmitted to the structure at anchor points.
3. Submit detailed routing and installation drawings of all raceway systems requiring seismic supports for review. Include attachment points, raceway sizes and methods proposed for securing and attaching.

H. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

I. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

J. Firestopping Engineering Judgments: For conditions not covered by UL listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
      a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
   1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance with State, Municipality, Highways, and Public Work's standard.

G. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.

E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.2 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage thick steel.

2.3 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Single component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   7. Firestop Pillows: Formed mineral fiber pillows.

B. Color: Dark gray.

2.7 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
   1. Mineral fiberboard.
   2. Mineral fiber matting.
   3. Sheet metal.
   4. Plywood or particle board.
   5. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish UL listed products.
   2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
1. Concrete Structural Elements: Provide precast inserts and expansion anchors.
2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts.
5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Inserts:
1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Place intumescent coating in sufficient coats to achieve rating required.

E. Remove dam material after firestopping material has cured.

F. Fire Rated Surface:
1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
c. Pack void with backing material.
d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
2. Where cable tray, bus, cable bus, conduit, wireway, and trough penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

G. Non-Rated Surfaces:
1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening as follows:
a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.

c. Install type of firestopping material recommended by manufacturer.

2. Install floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS (refer to plans for specific details).

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 260529

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit, surface raceways, J-hooks, wireways, outlet boxes, pull and junction boxes, concrete pullboxes and vaults, floor boxes.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. All wiring shall be installed in raceway.

C. Provide raceway as follows:
   1. Underground: Provide thickwall nonmetallic conduit. Provide cast metal boxes or nonmetallic handhole.
   2. In Slab Above Grade: Not permitted.
   3. Below Slab on Grade: Use thickwall nonmetallic conduit. Terminate with coated rigid steel elbows and short length of coated rigid steel conduit out of concrete.
   4. Outdoor Locations, Above Grade: Provide galvanized rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.
   5. Wet and Damp Locations: Provide galvanized rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

6. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes where shown on drawings. Provide J-hooks when shown on plans.
7. Exposed Interior Dry Locations: Use rigid steel conduit or intermediate metal conduit below eight feet or where subject to damage. Use rigid steel conduit, intermediate metal conduit, or electrical metallic tubing above eight feet or in electrical, mechanical or telecommunication rooms. Provide cast metal outlet, junction, and pull boxes. Use flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 0.75 inch unless otherwise specified.

B. Minimum Raceway Size for Data Communications: 1.00 inch unless otherwise specified.

C. Minimum Raceway Size for Telecommunications: 1.00 inch unless otherwise specified.

D. Minimum Raceway Size for AV Systems: 1.00 inch unless otherwise specified.

1.5 SUBMITTALS

A. Refer to Section 26 0000.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents:
1. Record actual routing of conduits larger than 2 inches.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

B. Coordinate Work of this Division and Work of other Divisions in advance of installation. Provide additional Work to overcome tight conditions at no increase in Contract Sum.

C. Coordinate installation of outlet boxes for equipment specified in other divisions.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Rigid Aluminum Conduit: ANSI C80.5.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1. Fittings shall be steel/malleable iron with threaded fittings. Use insulated metallic bushings with lug where ground connections are required. Use plastic bushing for non-bonding applications.

2.2 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket.

B. Fittings: NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; steel couplings and connectors. Box connectors shall have with insulated throat. Set screw type couplings.

2.6 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.7 SURFACE RACEWAY (WIREMOLD)

A. Product Description: Surface raceway as shown on plans. Raceway shall be Wiremold or equal.

B. Fittings: Provide all supports, adapters, clips, elbows, covers, device fittings, and other hardware as required for a complete installation. Provide B-Line “transition” boxes to clear offset surfaces. Supports shall be concealed, exposed straps are not allowed.

C. Finish:
1. Steel raceway and associated transition boxes and exposed hardware shall be spray painted with two coats of semi-gloss acrylic enamel paint, color as directed by Architect.

2. Aluminum raceway shall be provided with factory finish, color as directed by Architect. Transition boxes shall be spray painted with two coats of semi-gloss acrylic enamel paint, color as directed by Architect.
3. Plastic raceway shall be provided with factory finish, color as directed by Architect. Transition boxes shall be spray painted with two coats of semi-gloss acrylic enamel paint, color as directed by Architect.
4. Coordinate all colors with Architect prior to ordering.

2.8 J-HOOKS

A. Product Description: Low voltage signal cable J-Hooks shall be Caddy CableCat CAT425 for main runs. From main runs, provide Caddy CableCat CAT21 or CAT32 J-Hooks. Provide with support device for construction encountered.

2.9 WIREWAY

A. Product Description: General purpose for indoor applications and raintight type for outdoor locations wire way.

B. Knockouts: Manufacturer's standard.

C. Cover: Hinged cover with full gaskets.

D. Connector: Flanged.

E. Fittings: Lay-in type with removable top, bottom, and side; captive screws and drip shield for outdoor.

F. Finish: Rust inhibiting primer coating with gray enamel finish.

2.10 OUTLET BOXES

A. All boxes shall be suitable for the environment in which they are installed.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 0.5-inch male fixture studs where required.
2. Boxes for shall be 1.5-inch-deep by 4-inch square minimum for single devices.
3. Boxes for shall be 1.5-inch-deep by 4-11/16 inch square minimum for two devices.
4. Boxes for data and signal outlets shall be 2-1/8-inch-deep by 4-11/16-inch square minimum.
5. Concrete Ceiling Boxes: Concrete type.
6. Provide rings as required.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

2.11 Box Extensions

A. At rooms being remodeled and where existing walls are to receive new finish material, replace existing plaster rings with new rings.

2.12 PULL AND JUNCTION BOXES

A. Boxes having an internal volume less than 100 cubic inches shall be as specified for outlet boxes. Boxes having internal volume greater than 100 cubic inches shall be of panelboard type construction except that covers shall be secured by screws or bolts.

B. Boxes exposed to rain or installed in wet locations shall be specifically designed for the purpose.

C. All boxes shall be installed so that covers are accessible after completion of the installation.

D. Boxes shall not be installed in finished areas unless specific approval for such installation is granted by Architect.

2.13 CONCRETE PULLBOXES AND VAULTS

A. Boxes: Boxes shall be precast, high density reinforced concrete. In areas of vehicular traffic, boxes shall be H20 rated.

B. Extensions: Extensions shall be provided at each pullbox. Provide a minimum of (1) extension. Provide additional extension(s) as required to provide space in box for code required cable bending.

C. Covers: Covers in concrete or asphalt shall be galvanized. In all other areas, covers shall be steel checker plate. In areas of vehicular traffic, lids shall be galvanized steel, H20 rated. All covers shall be provided with hold-down bolts.

D. Floor: Provide poured concrete slab as detailed on plans. At H20 rated boxes, provide manufacturer’s concrete slab.

E. Size: Provide size as noted on plans. If size is not shown, provide boxes sized per codes.

F. Labeling: Covers shall be factory marked as shown on plans.

2.14 Flush Multi Service Floor Boxes (4 Port)

A. Floor boxes shall be cast iron, fully adjustable, Walker RFB4-CI-1 with FPBTCAL cover. Provide brackets required to mount devices shown on plans. Provide blank plates at unused ports.

2.15 Flush Multi Service Floor Boxes (11 Gang):

A. Floor boxes shall be steel, fully adjustable, Walker RFB11 with RFB119BTCAL cover. Provide brackets required to mount devices shown on plans. Provide blank plates at unused ports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods [compatible with existing electrical installations, or] as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

G. At rooms being remodeled and where existing walls are to receive new finish material, replace existing plaster rings with new rings with depth required to bring box flush with new finish. Contractor shall review Architectural drawings prior to bid to note walls receiving new finishes (tackboards, sheetrock, etc.) and include the necessary work in bid.

3.3 INSTALLATION

A. Ground and bond raceway and boxes.

B. Fasten raceway and box supports to structure and finishes.

C. Identify raceway and boxes.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Unless otherwise specified, all raceway shall be installed concealed. Raceway may be run exposed on unfinished walls, in attic spaces, in electrical rooms and when routed to surface panels, cabinets or gutters.

C. Arrange raceway supports to prevent misalignment during wiring installation.

D. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related raceway; support using conduit rack. Construct rack using steel channel and provide space on each for 25 percent additional raceways.

F. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

G. Do not attach raceway to ceiling support wires or other piping systems.

H. Construct wire way supports from steel channel.

I. Route exposed raceway parallel and perpendicular to walls.

J. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

K. Route conduit in and under slab from point-to-point.

L. Maintain clearance between raceway and piping for maintenance purposes.

M. Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

N. Cut conduit square using saw or pipe cutter; de-burr cut ends.

O. Bring conduit to shoulder of fittings; fasten securely.

P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

Q. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

R. Install no more than equivalent of three 90-degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2-inch size.

S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

T. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.

U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

W. Surface Raceway:
   1. Anchor raceway to structural members using screws. Supports shall be concealed. Space screws 24” maximum on center. Each run shall have a minimum of (2) screws.
   2. Mount plumb and level.
   3. Install insulating bushings and inserts at connections to outlets and corner fittings.

4. Raceway shown on plans is schematic. Contractor shall coordinate exact routing and installation with building conditions and provide all parts, pieces, elbows, transition boxes and other items as required for a complete, closed and professionally installed installation.
5. Coordinate exact routing with Architect prior to installation.

X. J-Hooks:
1. Provide J-hooks 48” maximum on center.
2. All cable to be run parallel and perpendicular to building lines.
3. Provide mounting hardware as required.
4. Provide Unistrut channels between structural members as required.
5. Provide 24” long 2” conduit sleeves through walls, draft stops, etc. Provide as many as necessary to accommodate cables in contract plus two extra capped at each end for future cabling. All conduits shall be provided with bushed ends.

Y. Existing Raceways
1. Where new wiring is shown to be installed in existing raceways, existing conductors shall be removed and repulled with new conductors if required.
2. When existing conductors are removed and repulled, they shall be tested prior to removal and tested again after reinstallation. Notify Owner in writing of any defects in existing wiring prior to removing.

Z. Close ends and unused openings in wire way.

AA. Excavating and trenching:
1. Perform all excavations as required for the installation of the work included under this Section, including shoring of earth banks to prevent cave-ins and to protect workmen and equipment.
2. Restore all surfaces, roadways, walks, curbs, walls, existing underground installation, etc., damaged or cut as a result of the excavations to their original condition in a manner approved by the Architect.
3. Stop machine excavation for trenches, in solid ground, several inches above required grade line, then trim trench bottom by hand to accurate grade so that a firm and uniform bearing throughout entire length of duct is provided. In lieu of above hand excavation in bottom of trench, Contractor may excavate to depth no less than 6" below required grade line and place a bed of sand or granular soil, properly compacted to provide a uniform grade and to provide a firm support for duct throughout its entire length.
4. Minimum conduit depth of pipe crown shall be 2'0" below finished or natural grade, unless detailed otherwise on Drawings. Conduits under parking lots, roadways, driveways, fire truck access routes, and other areas subject to vehicular traffic shall be installed a minimum of 24" below grade.

BB. Backfilling:
1. No backfilling operations shall begin until the required tests and inspection has been made. Should any of the work be enclosed or covered up before it has been approved, Contractor shall, at his expense, uncover the work.
2. After it has been inspected, tested, and approved, he shall make all repairs necessary to restore the work of other contractors to the condition in which it was found at the time of uncovering.

3. Except under existing paved area, walks, roads, or similar surfaces, and in cases where rock is encountered, backfill more than 12" above the top of the pipe shall be made using suitable excavated material placed in 6" layers measured before compaction, and tamped by machine.
4. Surface work shall be replaced to match the existing.
5. Entire backfill for bored excavations under existing pavement, walks, roads, or similar surfaces, shall be made with clean sand compacted by flooding.
6. The contractor shall install a marking tape 6” below grade and directly above all electrical conduits. The tape shall consist of a 4 mil insert plastic film specifically formulated for prolonged use underground. It shall be highly resistant to alkalis, acids and other destructive agents found in the soil. Tape shall have a minimum tensile strength of 20 lbs. per 3” with strips and a minimum elongation of 500%. Tape shall bear a continuous painted message repeated every 16” to 36” warning of the installation buried below. The message shall read “CAUTION – ELECTRICAL POWER LINE BURIED BELOW” or “CAUTION – ELECTRICAL SIGNAL LINES BURIED BELOW” as applies. Installation instruction for the tape shall be printed with each message along the entire length. The tape shall be as that manufactured by Reef Industries, Inc., or approved equal. For those installations involving non-metallic pipe, tape shall be aluminum foil encased in two layers of inert plastic film enabling the tape to be inductively located. Terre Tape “D” Warning Tapes are acceptable. When conduit below is plastic, tape shall have metallic content and shall respond to metal detectors. Do not exclude this. It will be required to verify the installation of this tape.

CC. Flashing and Sealing:
1. Flash and counterflash roof and wall penetrations in manner described under other applicable sections of this Specification and as approved by the Architect.
2. Conduits, ducts, etc., passing through finished walls and ceilings shall be fitted with steel escutcheon plates, chrome or paint finish as directed.
3. Conduits which penetrate floor slabs and concrete or masonry walls shall be grouted and sealed watertight at penetration.
4. Conduits penetrating exterior walls other than concrete or masonry shall be sealed watertight with polyurethane sealant.
5. Underground conduits stubbing up into a room shall be sealed around cables or pullstring with foam sealant.
6. All flashing and sealing shall be provided by this Contractor.

3.5 INSTALLATION – BOXES

A. Boxes shall be accurately placed as shown on Drawings or as close thereto as possible. Contractor shall refer to Drawings, specifications, and submittals covering work of the other trades to coordinate outlet location. In the event of conflict between planned locations of outlet and other equipment or furnishing, Contractor shall not proceed until direction has been given by Architect.

B. Unless otherwise specified or shown on Drawings, boxes shall be flush mounted with front edge of box or ring flush with wall or ceiling finish. Use plaster ring of appropriate depth in plastered or gypboard applications. Contractor shall review architectural drawings and note wall and ceiling construction and finishes for each wall.

C. Boxes shall not be installed back-to-back in walls. To prevent sound transfer, outlets, switches, etc. shown on opposing sides of the same wall shall be installed in separate stud spaces, except that outlets installed at different elevations may occupy the same stud space when box separation exceeds 18". Where these requirements cannot be met, Contractor shall provide insulation material between boxes.

D. Orient boxes to accommodate wiring devices.

E. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

F. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

G. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

H. Install stamped steel bridges to fasten flush mounting outlet box between studs.

I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

J. Install adjustable steel channel fasteners for hung ceiling outlet box.

K. Do not fasten boxes to ceiling support wires or other piping systems.

L. Support boxes independently of conduit.

M. Install gang box where more than one device is mounted together. Do not use sectional box.

N. Install gang box with plaster ring for single device outlets.

3.6 INSTALLATION CONCRETE PULLBOXES AND VAULTS

A. Install boxes flush with finished grade or surface material.

B. Install hold down bolts for all covers.

C. Ground bond steel cover plate with insulated green grounding conductor.

D. Grout between box and extension(s).

E. Any box installed in areas of vehicular traffic shall be H20 rated. Contractor shall verify this requirement prior to ordering.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

C. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.8 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.9 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 260533

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nameplates.
2. Device labels.
3. Wire markers.
4. Low voltage cable markers.
5. Underground warning tape.
6. Brass tags.

1.2 SUBMITTALS

A. Product Data:
1. Refer to section 26 0000.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with State, Municipality, Highways, Public Work's standard.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept identification products on site in original containers. Inspect for damage.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved white letters on black contrasting background color.

B. Letter Size:
1. 0.125 inch high letters for identifying individual equipment and loads.
2. 0.25 inch high letters for identifying grouped equipment and loads.

C. Minimum nameplate thickness: 0.125 inch.

2.2 DEVICE LABELS

A. Labels: Embossed adhesive tape, with 0.125 inch white letters on black background.

2.3 WIRE MARKERS

A. Description: Self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips. Blank markers shall be inscribed using the printer or pen recommended by manufacturer for this purpose.

2.4 LOW VOLTAGE CABLE MARKERS

A. Small markers: Open marker sleeve with label pocket for snap mounting on cable, yellow with white label, T&B PTC Series or as noted on Plans.

B. Large markers: Nomex, yellow, Brady B-508.

2.5 UNDERGROUND WARNING TAPE

A. Refer to applicable specification section for underground conduit or detail on plans.

2.6 BRASS TAGS

A. Description: 2” Round, 20 gauge brass.

B. Letter Size: 0.25 inch minimum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment.

C. Replace lost nameplates, labels, and markers.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplates
1. Install nameplate parallel to equipment lines.
2. Install nameplates with screws or rivets.
3. Secure nameplate to the front of equipment.
4. Install nameplates for the following:

a. Switchboards.
b. Distribution Panelboards.
c. Breakers at individual breakers in switchboards, switchgear and distribution panelboards.
d. Panelboards.
e. Transformers.
f. Service Disconnects.
g. Fused and Non-Fused Disconnects.
h. Signal terminal backboards.
i. Signal terminal cabinets.
j. Terminal blocks at terminal backboards and cabinets.
k. Boxes and cabinets containing control equipment.
l. Signal system control panels, power supplies, amplifiers, etc.

5. Provide nameplates that present, as applicable, the following information:
   a. Equipment or device designation.
   b. Amperage, kVA, or horsepower rating where applicable.
   c. Voltage or signal system name.
   d. Source or power or control.
   e. Examples:
      1) Boards: PANEL HA; 1000A; 277/480V, 3-Phase, 4-Wire, FED FROM SWITCHBOARD MSB IN ROOM ###.
      2) Transformers: TRANSFORMER T-1; 112.5kVA; 480V to 120/208V, 3-Phase, 4-Wire; Served from H2A; Load Served L2A.
      3) Disconnects and Individual Motor Starters: AC-A1; 25HP; 480V, 3-Phase, 3-Wires; Served from HA-4/6/8.
      4) Available Fault Current: XX,XXX Amperes. Date Calculated: XX/XX/XX.
      5) Breakers: 200A; 3-POLE.
      6) Terminal Backboards: SIGNAL TERMINAL BACKBOARD STB-A.
      7) Terminal Cabinets: SIGNAL TERMINAL CABINET STC-A.

C. Device Labels
1. Install label parallel to equipment lines.
2. Install labels for permanent adhesion and seal with clear lacquer.
3. Install labels on device faceplate.
4. Install labels to indicate the circuit number of device.
5. Install labels for the following:
   a. Receptacles
   b. Controlled receptacles
   c. Fire alarm devices located above ceilings. Install label on access door or on t-bay at lay-in ceilings.
   d. As noted on plans.
6. Examples:

a. Receptacle: LA1-15.
b. Controlled Receptacle: CONTROLLED.
c. FA device above ceiling: DETECTOR ABOVE CEILING.

D. Wire Markers
1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
2. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
3. Signal and Control Circuits: Control wire number as indicated on shop drawings.

E. Low Voltage Cable Markers
1. Install at each cable in terminal cabinets and terminal backboards.
2. Install at each bundle of cables in each underground vault or pullbox. Provide one marker for each system.

F. Junction Boxes
1. Identify all junction boxes located above suspended ceilings and below ceilings in non-public areas.
2. Boxes shall be identified with permanent felt tip marker on cover indicating panel and circuit numbers or signal system.

G. Underground Warning Tape
1. Refer to applicable specification section for underground conduit or to detail on plans.

H. Brass Tags:
1. Provide brass tags for all feeder cables in underground vaults and pull boxes.
2. Example: PANEL LA FEEDER.

END OF SECTION 260553

SECTION 260573 – POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Short-circuit study.

B. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

C. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

D. Study encompassing portions of electrical distribution system from normal power source or sources up to and including breakers in service entrance switchboard, fuses in service entrance switchboard, main breaker in sub-distribution panels, fuses in sub-distribution panels, and main breaker in each panelboard.

1.2 REFERENCES

A. American National Standards Institute
   1. ANSI Z535.4 Product Safety Signs and Labels

B. Institute of Electrical and Electronics Engineers:
   1. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).
   2. IEEE 1548 – Guide for Performing Arc-flash Hazard Calculations

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code with California Amendments.
   2. NFPA 70E – Standard for Electrical Safety in the Workplace.

1.3 DESIGN REQUIREMENTS

A. Complete Short Circuit and Protective Device Coordination Study to meet requirements of NFPA 70 with California Amendments.

B. Report Preparation:
   1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
   2. Perform study with aid of computer software program.
   3. Obtain actual settings for packaged chiller and motor characteristics and for equipment incorporated into Work.

4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
   a. Utility supply bus.
   b. Medium voltage air interrupter switchgear.
   c. Medium voltage circuit breaker switchgear.
   d. Switchboards.
   e. Distribution panelboards.
   f. Branch circuit panelboards.
   g. Each other significant equipment location throughout system.
5. Electric utility modeled as an infinite bus will not be accepted.
6. Include all applicable modes of operation based on the available normal and emergency sources and switching configurations.
7. Perform Arc-flash Hazard Calculation per IEEE-1548.
8. Coordinate with the facility to obtain the complete facility one-line diagram prior to bidding.

C. Report Contents:
   1. Include the following:
      a. Calculation methods and assumptions.
      b. Base per unit value selected.
      c. One-line diagram.
      d. Source impedance data including power company system available power and characteristics.
      e. Typical calculations.
         1) Fault impedance.
         2) X to R ratios.
         3) Asymmetry factors.
         4) Motor fault contribution.
         5) Short circuit kVA.
         6) Symmetrical and asymmetrical phase-to-phase and phase-to-ground fault currents.
         7) Tabulations of calculation quantities and results.
      f. One-line diagram revised by adding actual instantaneous short circuits available.
      g. State conclusions and recommendations.
   2. Prepare detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

1.4 SUBMITTALS

A. Qualifications Data: Submit the following for review prior to starting study.
   1. Submit qualifications and background of firm.
   2. Submit qualifications of individual or individuals or Professional Engineer performing study.

B. Software: Submit for review information on software proposed to be used in performing study.

C. Product Data: Submit the following:

1. Report: Summarize results of study in report format including the following:
   a. Descriptions, purpose, basis, and scope of study.
   b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
   c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
   d. Fault current calculations including definition of terms and guide for interpretation of computer printout.

D. Submit copies of final report signed by professional engineer. Make additions or changes required by review comments.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State of Public Work's standard.

B. Maintain one copy of each document on site.

C. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of two years documented availability approved by the Engineer.

D. Perform study in accordance with IEEE 242.

E. Perform arc flash study in accordance with IEE 1584-2018 for system up to 15 kV.

1.6 QUALIFICATIONS

A. Study Preparer: Company specializing in performing work of this section with minimum two years documented experience and having completed projects of similar size and complexity within the past two years.

B. Perform study under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of California with minimum of two years' experience in power system analysis.

C. Demonstrate company performing study has capability and experience to provide assistance during system start up.

1.7 pre-installation meetings

A. Convene minimum one week prior to commencing work of this section.

1.8 SEQUENCING

A. Complete study within 8 weeks after receiving all pertinent information to perform the study.

B. Allow 4 weeks for review of completed study by Architect/Engineer.

C. Submit short circuit and protective device coordination study to Architect/Engineer prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.

D. When formal completion of study will cause delay in equipment manufacturing, obtain approval from Architect/Engineer for preliminary submittal of study data sufficient in scope to ensure selection of device ratings and characteristics will be satisfactory.

1.9 SCHEDULING

A. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

1.10 COORDINATION

A. Coordinate work with local power company.

PART 2 - PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Follow facility standards were applicable.

B. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
   1. Minimum Size: 4 by 6 inches.
   2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
      a. Include orange header that reads "WARNING" unless otherwise indicated.
      b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
      c. Include the following information:
         1) Arc flash boundary.
         2) Available incident energy and corresponding working distance.
         3) Site-specific PPE (personnel protective equipment) requirements.
         4) Nominal system voltage.
         5) Limited approach boundary.
         6) Restricted approach boundary.
         7) Equipment identification.
         8) Date calculations were performed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels.

3.2 FIELD QUALITY CONTROL

A. Provide assistance to electrical distribution system equipment manufacturer during startup of electrical system and equipment.

B. Select each primary protective device for delta-wye connected transformer so device's characteristic or operating band is within transformer characteristics, including point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection.

C. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by 16 percent current margin to provide proper coordination and protection in event of secondary line-to-line faults.

D. Separate medium-voltage relay characteristic curves from curves for other devices by at least 0.4 second time margin.

3.3 ADJUSTING

A. Perform field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Adjust settings in accordance with approved short circuit and protective device coordination study.

END OF SECTION 260573

SECTION 26 08 00

ELECTRICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process relative to division 26.
B. The commissioning process is primarily the responsibility of the Commissioning Authority, with support for start-up, testing, and commissioning the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process, or diminish the role and obligations to complete all portions of work in a satisfactory and fully operational manner.
C. Work of Division 26 includes:
    1. Testing and start-up of the electrical equipment.
    2. Providing qualified personnel to assist in commissioning tests to verify equipment/ system performance.
    3. Completion and endorsement of pre-functional test checklists provided by the Commissioning Authority to assure that Division 26 equipment and systems are fully operational and ready for functional testing.
    4. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
    5. Providing training for the systems specified in Division 26 with coordination of owner by the Commissioning Authority.

1.2 RELATED WORK

A. All testing and start-up procedures and documentation requirements specified within Division 26.
B. Section 01 9100 - General Commissioning Requirements
C. Commissioning functional test procedures that require participation of the Contractors.
D. Cooperate with the Commissioning Authority in the following manner:
    1. Allow sufficient time before final completion dates so that testing can be accomplished.
    2. Provide labor and material to make corrections when required without undue delay.
    3. Coordinate all required support of that equipment which is provided to or installed with involvement of Division 23 contractors.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Standard certified test equipment for commissioning shall be provided by the Division 26 Contractor.

B. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so the system can be started, tested, balanced, and otherwise commissioned. Division 26 has temporary power and start-up responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment and materials per the contract documents and related directives, clarifications, change orders, etc.

B. The Commissioning Authority will develop a Commissioning Plan. Upon request of the Commissioning Authority, the Contractor shall provide assistance and consultation. The Commissioning Plan will be developed prior to completion of the installation. The Contractor is obligated to assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation.

C. Specific pre-commissioning responsibilities of Division 26 are as follows:
   1. Normal start-up services required to bring each system into a fully operational state. The Commissioning Authority will not begin the commissioning process until each system is complete and documented, including normal contractor start-up.
   2. The Contractor shall perform pre-functional tests on the equipment and systems as noted in section 01 9100 General Commissioning Requirements.
   3. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Authority.
   4. Pre-functional test forms will be kept in the Contractors job trailer in a Commissioning Field Notebook provided by the Commissioning Authority.
   5. Factory start-up services will be provided for key equipment and systems specified in Division 26. The Contractor shall coordinate this work with the manufacturer and the Commissioning Authority.

D. Commissioning is intended to begin upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is in the best interests of the Owner. Commissioning activities and schedule will be coordinated with the Contractor. Start of commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.

E. The Field Commissioning Notebook will be used to identify and track all pertinent commissioning documentation required during the Installation phase. This Notebook will be assembled by the Commissioning Authority and maintained by the Contractor. The Notebook provides a central location for the Commissioning Authority to identify, copy and organize all pertinent information and will include the following format:
   1. Summary describing Notebook contents and use.
   2. Copy of Commissioning Plan for contractor field reference.
   3. Listing of all specification documentation requirements listed by specification section, with sign off spots for appropriate contractors.

4. Tabs for each specification section with copies of pre-functional test check sheets provided by coordination of subcontractors and Commissioning Authority for contractor completion and space for related contractor-supplied documents.
5. Prior to functional testing the Commissioning Authority will use this book to verify that all appropriate contractors have completed their work and signed off that they have done so. Once the Commissioning Authority is satisfied that all components of a system are complete functional testing will begin.

3.2 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start up and debug all systems within the division of work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

3.3 WORK TO RESOLVE DEFICIENCIES

A. Maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet the original design intent. Correction of work will be completed under the direction of the Architect, with input from the Contractor, equipment supplier, and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect/Engineer of Record will have final jurisdiction on the necessary work to be done to achieve performance and or design intent.

3.4 ADDITIONAL COMMISSIONING

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their standard contractual obligations.

3.5 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.

B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.
C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.6 TRAINING

A. The Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each mechanical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.
B. Training will be conducted jointly with the Commissioning Authority, the design engineers, the equipment vendors, and the Contractor. The Contractor will be responsible for the generic training, as well as instructing the Owner's staff on the system peculiarities specific to this project.

3.7 SYSTEMS DOCUMENTATION

A. Contract Documents to incorporate field changes and revisions to system designs to account for actual constructed configurations will be addressed as required in Division 1. All drawings should be red-lined on two sets. Division 26 as-built drawings should include updated architectural floor plans, and the individual electrical systems in relation to actual building layout.
B. Maintain as-built red-lines on the job site as required in Division 1.
C. In addition to the stated requirements for operation and maintenance data, provide one copy of equipment technical literature, operation and maintenance literature, and shop drawings to the Commissioning Authority as soon as they are available. This requirement is for review of these documents prior to distribution of multiple copies for the Owner's final use.

END OF SECTION

SECTION 262200 – LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

END OF SECTION 260526

PART 2 - GENERAL

2.1 SUMMARY

A. Section Includes:
1. Two-winding transformers.
2. Shielded transformers.
3. Autotransformers.
4. Buck-and-boost transformers.

2.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
1. NEMA ST 1 - Specialty Transformers (Except General Purpose Type).
2. NEMA ST 20 - Dry Type Transformers for General Applications.

B. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

2.3 SUBMITTALS

A. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

B. Test and Evaluation Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

C. Source Quality Control Submittals: Indicate results of factory tests and inspections.

D. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

2.4 CLOSEOUT SUBMITTALS

A. Record Documentation: Record actual locations of transformers.

2.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

2.6 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 3 - PRODUCTS

3.1 TWO-WINDING TRANSFORMERS

A. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on Drawings.

B. Operation:
1. Primary Voltage: 480 volts, 3-phase.
2. Secondary Voltage: 208Y/120 volts, 3-phase.
3. Insulation system and average winding temperature rise for rated kVA as follows:
4. 1-15 kVA: Class 185 with 80 degrees C rise.
5. 16-500 kVA: Class 220 with 150 degrees C rise.
6. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
7. Winding Taps:
   a. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
   b. Transformers 15 kVA and Larger: NEMA ST 20.
8. Sound Levels: NEMA ST 20.
9. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.
10. Mounting as indicated on drawings.

C. Materials:
1. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
2. Coil Conductors: Continuous copper windings with terminations brazed or welded.

3. Enclosure: NEMA ST 20, Type 1 for indoor and Type 3R for outdoor applications ventilated. Furnish lifting eyes or brackets.

D. Fabrication:
1. Isolate core and coil from enclosure using vibration-absorbing mounts.
2. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

3.2 SHIELDED TRANSFORMERS

A. Description: NEMA ST 20, factory-assembled, air-cooled, dry type shielded isolation transformers, ratings as indicated on Drawings.

B. Operation:
1. Primary Voltage: 480 volts, 3-phase.
2. Secondary Voltage: 208Y/120 volts, 3-phase.
3. Insulation system and average winding temperature rise for rated kVA as follows:
a. 10-15 kVA: Class 185 with 115 degrees C rise.
b. 16-500 kVA: Class 220 with 150 degrees C rise.
4. Case temperature: Do not exceed 50 degrees C rise above ambient at warmest point at full load.
5. Winding Taps:
a. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
b. Transformers 15 kVA and Larger: NEMA ST 20.
6. Sound Levels: NEMA ST 20.
7. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.
8. Winding Shield: Electrostatic, with separate insulated grounding connection.
9. Mounting as indicated on drawings.

C. Materials:
1. Ground core and coil assembly to enclosure with visible flexible copper grounding strap.
2. Coil Conductors: Continuous copper windings with terminations brazed or welded.
3. Enclosure: NEMA ST 20, Type 1 for indoor and Type 3R for outdoor applications ventilated. Furnish lifting eyes or brackets.

D. Fabrication:
1. Isolate core and coil from enclosure using vibration-absorbing mounts.
2. Nameplate: Include transformer connection data.

3.1 AUTOTRANSFORMERS

A. Description: NEMA ST 20, factory-assembled, air-cooled, dry type autotransformers, ratings as indicated on Drawings.

B. Operation:

1. Primary Voltage: 480 volts, 3-phase.
2. Secondary Voltage: 208Y/120 volts, 3-phase.
3. Insulation system and average winding temperature rise for rated kVA as follows:
   a. 10-15 kVA: Class 185 with 115 degrees C rise.
   b. 16-500 kVA: Class 220 with 150 degrees C rise.
4. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
5. Winding Taps:
   a. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
   b. Transformers 15 kVA and Larger: NEMA ST 20.
6. Sound Levels: NEMA ST 20.
7. Use three-legged core construction.
8. Mounting as indicated on drawings.

C. Materials:
1. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
2. Coil Conductors: Continuous copper windings with terminations brazed or welded.
3. Enclosure: NEMA ST 20, Type 1 for indoor and Type 3R for outdoor applications ventilated. Furnish lifting eyes or brackets.

D. Fabrication:
1. Isolate core and coil from enclosure using vibration-absorbing mounts.
2. Nameplate: Include transformer connection data.

3.2 BUCK-AND-BOOST TRANSFORMERS

A. Description: NEMA ST 1, factory-assembled, dry type two winding buck and boost transformers, ratings as indicated on Drawings.

B. Operation:
1. Insulation system and average winding temperature rise for rated kVA as follows:
   a. 0.25-2 kVA: Class 185 with 80 degrees C rise.
   b. 3-7.5 kVA: Class 220 with 115 degrees C rise.
2. Primary Voltage: 120 x 240 volts, single phase.
3. Secondary Voltage: 12/24 volts.

C. Materials:
1. Coil Conductors: copper continuous windings.
2. Lugs: Suitable for terminating conductors sized for full load ampacity of transformer unit when operating in buck-and-boost configuration shown.
3. Enclosure: NEMA ST 1, Type 1.

D. Fabrication:
1. Isolate core and coil from enclosure using vibration-absorbing mounts.

2. Nameplate: Include transformer connection data.

3.3 SOURCE QUALITY CONTROL

A. Production test each unit according to NEMA ST20.

PART 4 - EXECUTION

4.1 EXAMINATION

A. Verify mounting supports are properly sized and located including concealed bracing in walls.

4.2 PREPARATION

A. Provide concrete pads.

4.3 DEMOLITION

A. Disconnect and remove abandoned transformers.

B. Maintain access and adequate ventilation to existing transformers and other installations remaining active and requiring access and ventilation. Modify installation or provide access panel or ventilation grilles.

4.4 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Support transformers.
1. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.
2. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.
3. Mount trapeze-mounted transformers as indicated on Drawings.

D. Provide seismic restraints.

E. Install grounding and bonding.

4.5 REPAIR/RESTORATION

A. Repair existing transformers to remain or to be reinstalled.

4.6 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.2.1.

4.7 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

4.8 CLEANING

A. Clean existing transformers to remain or to be reinstalled.

END OF SECTION 262200

SECTION 262400 – SWITCHBOARDS AND PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Main and distribution switchboards.
   2. Distribution and branch circuit panelboards.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C12.1 - Code for Electricity Metering.
   2. ANSI C39.1 - Requirements, Electrical Analog Indicating Instruments.

B. Institute of Electrical and Electronics Engineers:
   1. IEEE C57.13 - Standard Requirements for Instrument Transformers.
   2. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

C. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   3. NEMA PB 2 - Deadfront Distribution Switchboards.
   4. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.
   5. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   6. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
   7. NEMA PB 1 - Panelboards.
   8. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

D. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

E. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code with California Amendments.

F. Underwriters Laboratories Inc.:
   1. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
   2. UL 891 - Dead-Front Switchboards.

3. UL 50 - Cabinets and Boxes
4. UL 67 - Safety for Panelboards.
5. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
6. UL 1283 - Electromagnetic Interference Filters.
7. UL 1449 - Transient Voltage Surge Suppressors.
8. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

A. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars for each phase, neutral, and ground; and switchboard instrument details.

B. Product Data: Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

C. Test Reports: Indicate results of factory production and field tests.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations, configurations, and ratings of switchboards and their components on single line diagrams and plan layouts.

B. Operation and Maintenance Data: Submit spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in 48-inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

B. Accept switchboards on site. Inspect for damage.

C. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 SEQUENCING

A. Sequence Work to avoid interferences with building finishes and installation of other products.

PART 2 - PRODUCTS

2.1 DISTRIBUTION SWITCHBOARDS

A. Product Description: NEMA PB 2, enclosed switchboard with electrical ratings and configurations as indicated on Drawings.

B. Device Mounting:
1. Main Section: Individually mounted and compartmented.
2. Distribution Section: Individually mounted.
3. Auxiliary Section: Individually mounted.

C. Bus:
1. Material: Copper standard size.
2. Connections: Bolted, accessible from front for maintenance.
3. Insulation: Fully insulate load side bus bars. Do not reduce spacing of insulated bus.

D. Ground Bus: Insulated, extend length of switchboard.

E. Minimum Short Circuit Rating: 65,000 symmetrical amperes rms, fully rated or as indicated on drawing.

F. Line and Load Terminations: Accessible from front of switchboard, suitable for conductor materials and sizes as indicated on Drawings.

G. Utility Metering Compartment: Furnish metering transformer compartment for Utility Company's use, in accordance with Utility Company requirements.

H. Pull Section: Size as indicated on Drawings.

I. Pull Box: Removable top and sides, same construction as switchboard size as indicated on Drawings.

J. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents. Furnish continuous current rating as indicated on Drawings.

K. Enclosure: Type 1 - General Purpose for indoor and Type 3R – Raintight for outdoor.

L. Align sections at front and rear.

M. Switchboard Height: 90 inches, excluding floor sills, lifting members and pull boxes.

N. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

O. Mimic Bus: Show bussing, connections and devices in single line form on front panels of switchboard using black color factory painting, fastened flat against panel face with screws.

2.2 DISTRIBUTION PANELS

A. Product Description: NEMA PB 2, enclosed switchboard with electrical ratings and configurations as indicated on Drawings.

B. Device Mounting:
1. Distribution Section: Individually mounted.

C. Bus:
1. Material: Copper standard size.
2. Connections: Bolted, accessible from front for maintenance.
3. Insulation: Fully insulate load side bus bars. Do not reduce spacing of insulated bus.

D. Ground Bus: Insulated, extend length of switchboard.

E. Minimum Short Circuit Rating: 65,000 symmetrical amperes rms, fully rated or as indicated on drawing.

F. Line and Load Terminations: Accessible from front of switchboard, suitable for conductor materials and sizes as indicated on Drawings.

G. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents. Furnish continuous current rating as indicated on Drawings.

H. Enclosure: Type 1 - General Purpose for indoor and Type 3R – Raintight for outdoor.

I. Switchboard Height: 90 inches, excluding floor sills, lifting members and pull boxes, or as detailed on plans.

J. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.3 DISTRIBUTION PANELBOARDS

A. Description: NEMA PB 1, circuit breaker type panelboard.

B. Operation:
1. Minimum integrated short circuit rating as indicated on Drawings.

C. Materials
1. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

2. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
3. Molded Case Circuit Breakers with Current Limiters: UL 489, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
4. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical A, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
5. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated on Drawings.
6. Surge Suppressers: Integrated in panelboard.
7. Enclosure: NEMA PB 1, Type 1 for indoor and 3R for outdoor applications.
8. Cabinet Front: Surface door-in-door type, fastened with concealed trim clamps, hinged door with flush lock, and metal directory frame.

D. Finishes:
1. Manufacturer's standard gray enamel.

2.4 BRANCH CIRCUIT PANELBOARDS

A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

B. Materials:
1. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
2. For non-linear load applications subject to harmonics furnish 200 percent rated, plated copper, solid neutral.
3. Minimum Integrated Short Circuit Rating or as indicated on Drawings.
4. Molded Case Circuit Breakers: UL 489, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Provide UL class 760 arc-fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers..
5. Directory holder shall be metal with clear plastic cover. Holder shall be welded to the inside of the door or epoxied in place by the contractor.
6. Directories shall be type-written
7. Circuit breaker numbers shall be adhesive backed engraved or stamped into deadfront. Snap-in plastic numbers or stick-on labels are not acceptable.
8. Provide panel skirts when called for on plans.

C. Enclosure:
1. NEMA PB 1, Type 1 for indoor and Type 3R outdoor applications.
2. 6 inches deep, 20 inches.
3. Finish in manufacturer’s standard gray enamel.
4. Exterior of surface mounted enclosures shall be factory painted to match the front.

D. Cabinet Front: Flush or surface cabinet front as indicated on drawings with door-in-door concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finishes:
   1. Finish in manufacturer's standard gray enamel.

2.5 CIRCUIT BREAKERS

A. Product Description: UL 489, molded-case circuit breaker.

B. All circuit breakers shall be bolt-on type.

2.6 ACCESSORIES

A. Circuit Breaker Lifting Device: Portable, floor supported, elevating carriage with roller base, for movement of circuit breakers in and out of switchboard structure.

B. Furnish thermostatically controlled electric heaters in each section, sized to prevent condensation under expected weather conditions at Project site. Furnish terminals for separate connection of heater power circuit. Voltage Rating: 120 volts.

C. Concrete: 3,000 psi.

2.7 SOURCE QUALITY CONTROL

A. Furnish shop inspection and testing in accordance with NEMA PB 2.

B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.

C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner at least seven days before inspections and tests are scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surface is suitable for switchboard installation.

3.2 DEMOLITION

A. Disconnect abandoned panelboards. Remove abandoned panelboards and load centers.

B. Maintain access to existing panelboard and load centers remaining active and requiring access. Modify installation or provide access panel.

3.3 EXISTING WORK

A. Disconnect and remove abandoned switchboards.

B. Maintain access to existing switchboards and other installations remaining active.

C. Clean and repair existing switchboards to remain or to be reinstalled.

3.4 INSTALLATION

A. Install in accordance with NEMA PB 2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install fuses in each switch and coordinate sizes with connected load.

D. Install engraved plastic nameplates.

E. Install breaker circuit directory.

F. Ground and bond switchboards.

G. Install panelboards according to NEMA PB 1.1.

H. Install panelboards plumb.

I. Install recessed panelboards flush with wall finishes.

J. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

K. Install filler plates for unused spaces in panelboards.

L. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads. Identify each circuit as to its clear, evident and specific purpose of use.

M. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Minimum spare conduits: five empty 1 inch. Identify each as spare.

N. Ground and bond panelboard enclosure. Connect equipment ground bars of panels according to NFPA 70.

O. Modifications to existing equipment shall be as indicated on the Drawings. New equipment shall match existing where possible and in all cases be compatible with existing. Where new breakers are installed in existing equipment, provide all hardware and trim pieces as required for a complete closed installation. Provide new nameplates at equipment where existing breakers are identified by nameplates and provide new breaker identification in directory where existing breakers are identified in a directory.

P. Where new breakers are indicated to be installed in existing equipment, but insufficient space exists, provide enclosed circuit breakers externally and tap existing bussing. Tap conduit and wire sizes shall be same as breaker line side conduit and wire.

3.5 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.1.

C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.

E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.6 ADJUSTING

A. Adjust operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections.

C. Adjust circuit breaker trip and time delay settings to values as indicated on Fault, Coordination, and ArcFlash Study.

D. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.7 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

B. Clean existing panelboards and load centers to remain or to be reinstalled.

END OF SECTION 262400

SECTION 262716 – ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hinged cover enclosures.
   2. Terminal and control equipment cabinets.
   3. Terminal backboards.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's standard data for enclosures, and terminal cabinets.

B. Manufacturer's Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Description: NEMA 250, Type 1 (Interior) and 3R (Exterior) steel enclosure.
   1. Covers: Continuous hinge, held closed by flush latch operable by key.
   2. Furnish interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
   3. Enclosure Finish: Manufacturer's standard enamel.

2.2 TERMINAL AND CONTROL EQUIPMENT CABINETS

A. Description:
   1. Interior locations: NEMA 1.
   2. Exterior locations: NEMA 3R.
   3. Boxes: Steel.
   4. Box Size: As required to house all conduits, wiring terminal blocks, modules, etc. or as indicated on drawings.
   5. Backboard: Furnish 5/8-inch-thick plywood backboard for mounting terminal blocks. Paint with (3) coats of fire retardant white paint.

6. Fronts: Hinged steel, flush or surface type with concealed trim clamps door with concealed hinge, to match branch circuit panelboard. Provide key lock at interior cabinets. Provide padlock hasp at exterior locations.

B. Finish: Finish with gray baked enamel.

2.3 Signal Terminal Backboards

A. Description: 0.75” Architectural grade plywood, 8’ high x width shown on plans.

B. Finish: Paint with (3) coats of fire-retardant white paint.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Remove abandoned cabinets and enclosures, including abandoned cabinets and enclosures above accessible ceiling finishes. Patch surfaces.

B. Maintain access to existing cabinets and enclosures and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Extend existing cabinets and enclosures using materials and methods as specified.

3.2 REPAIR/RESTORATION

A. Repair existing cabinets and enclosures to remain or to be reinstalled.

3.3 INSTALLATION

A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.

B. Install cabinet fronts plumb.

C. Install interior cabinets with top of enclosure 6’6” above finished floor.

D. Install exterior cabinets with top of enclosure 6’6” above finished grade.

E. Install terminal backboards with sanded side exposed.

F. Provide ground bus at each terminal backboard.

3.4 CLEANING

A. Clean existing cabinets and enclosures to remain or to be reinstalled.

B. Clean electrical parts to remove conductive and harmful materials.

C. Remove dirt and debris from enclosure.

D. Clean finishes and touch up damage.

END OF SECTION 262716

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; receptacles; device plates; and decorative box covers.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Product Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.

B. Body and Handle: Gray plastic with toggle handle.

C. Ratings:
   1. Voltage: 120-277 volts, AC.
   2. Current: 20 amperes.

D. Wiring: Back and side wired. Back wiring with clamp type terminals suitable for stranded or solid wire.

2.2 Low voltage switches/dimmers

A. Refer to lighting control details and/or specifications.

B. Color: Gray.

2.3 RECEPTACLES

A. Product Description: NEMA 5-20, 20 amp, decora, unless noted otherwise.

B. Color: Gray, unless noted otherwise.

C. Wiring: Back and side wired. Back wiring with clamp type terminals suitable for stranded or solid wire.

D. Standard Receptacles: Commercial Grade, Heavy-Duty, Tamper-Resistant, Leviton TDR20-GY.

E. Controlled Receptacles:
   1. Half Controlled: Commercial Grade, Tamper-Resistant, White, Leviton TDR20-S1W.
   2. Dual Controlled: Commercial Grade, Tamper-Resistant, White, Leviton TDR20-S2W.

F. Ground Fault Interrupting (GFI) Receptacles: Commercial Grade, Tamper-Resistant, Lockout Feature (disables receptacle when GFI protection is compromised), Self Testing, LED Indicator Light
   1. Interior Dry Locations: Leviton GFTR2-GY
   2. Exterior, Wet or Damp Locations: Weather-Resistant, Leviton GFWT2-GY
   3. Receptacles for Refrigerators and Freezers: Audible Trip Alert, Ivory, Leviton GFTA2-I.

G. Receptacles for Computer Use: Commercial Grade, Tamper-Resistant, Surge Protected, Indicator Light, Leviton T5380-GY.

H. Special Purpose Receptacles: Type and rating and number of poles indicated or required for the anticipated purpose.

2.4 WALL PLATES

A. Decorative Cover Plates: Stainless Steel.

B. Weatherproof Cover Plates:
   1. For devices at grade or areas accessible to pedestrians: Cast aluminum cover with spring-loaded door and appropriate mounting plate, Legrand 4600-26.
   2. For devices on roof or where not accessible to pedestrians: While-in-use cover, metal, Cooper WIUMV-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

A. Disconnect and remove abandoned wiring devices.

B. Modify installation to maintain access to existing wiring devices to remain active.

C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on top.

F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

G. Install wall plates on flush mounted switches, receptacles, and blank outlets.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

L. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.

M. Whether indicated on the plans or not, provide GFI receptacles for the following conditions:
   1. Within 6 feet of sinks.
   2. In toilet rooms.
   3. In kitchens.
   4. Serving electric drinking fountains.

N. Where receptacles are to be GFI type or surge suppression, each receptacle shall be GFI or surge suppression. Contractor may not use standard receptacles connected for “downstream” protection.

O. Unless noted otherwise, do not use combination switch/receptacle devices.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes to obtain mounting heights as specified and as indicated on Architectural elevations.

B. Install wall switch 44 inches to center of box above finished floor.

C. Install convenience receptacle 18 inches to center of box above finished floor.

D. Install convenience receptacle 6 inches to center of box above counter or back splash of counter.

E. Install dimmer 44 inches to center of box above finished floor.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 262816 – ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fusible Disconnect Switches.
   2. Nonfusible Disconnect Switches.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Operation:
   1. Switch Ratings
      a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
      b. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere). 200,000 rms

symmetrical amperes when used with or protected by Class R or Class J fuses 30-600 ampere switches employing appropriate fuse rejection schemes). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

C. Materials:
1. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
2. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
   a. Interior Dry Locations: Type 1.
   b. Exterior Locations: Type 3R.
   c. Industrial Locations: Type 12.
3. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
4. Furnish switches with entirely copper current carrying parts.
5. Viewing Window.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Operation:
1. Switch Ratings
   a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
   b. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere). 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses 30-600 ampere switches employing appropriate fuse rejection schemes). 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

C. Materials:
1. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
   a. Interior Dry Locations: Type 1.
   b. Exterior Locations: Type 3R.
   c. Industrial Locations: Type 12.
2. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
3. Furnish switches with entirely copper current carrying parts.
4. Viewing Window.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Disconnect and remove abandoned enclosed switches.

B. Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.

3.2 INSTALLATION

A. Install enclosed switches where indicated.

B. Install enclosed switches plumb. Provide supports.

C. Height: 5 feet to operating handle.

D. Install fuses for fusible disconnect switches.

E. Install engraved plastic nameplates. Engrave nameplates with the equipment served and the panel and circuit number supplying the switch.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.3 REPAIR/RESTORATION

A. Repair existing enclosed switches to remain or to be reinstalled.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.5 CLEANING

A. Clean existing enclosed switches to remain or to be reinstalled.

END OF SECTION 262816

SECTION 283100 – INTRUSION ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

END OF SECTION 260526

1.1 WORK INCLUDED

A. General Conditions and requirements of Division 1 and Section 26 0000 apply to work hereunder.

B. Furnish and install extensions to the existing Intrusion Alarm System including all wiring and connections and other materials as shown on Plans and specified herein. It is the intent that a complete operating system be installed and that any power supplies, relays, resistors, cards, modules, programming, or other items required to achieve this end result shall be furnished whether or not such item or items are specified herein.

C. Site and System Investigation: System bidder shall visit site prior to bid and become thoroughly knowledgeable about all aspects of the existing system and work required to perform work of this section. Bidder shall verify the manufacturer and model of the existing system and all components/devices required. Failure to discover the equipment, materials, and labor required to complete the extensions will not relieve the contractor from completing the work at no additional cost.

D. Proprietary Systems: Where school is protected and monitored by a proprietary system, such as ADT or Sonitrol, Contractor shall coordinate the exact requirements with those firms. If the Division 16 Contractor elects to use a sound and signal firm other than the proprietary company, the sound and signal firm must include in bid, the materials, equipment, and labor required by the proprietary company to make the extensions complete and fully functional.

1.2 GENERAL REQUIREMENTS

A. System Requirements: All of various equipment components to be complete with all appurtenant accessories required to provide specified facilities and perform specified functions throughout presently planned construction and space; and provisions for expanding system to provide same facilities, and perform same functions in all future planned construction, including space and mountings in control panels and terminal backboards.

B. Interruption of Service: Existing intrusion alarm system must be kept operational during unoccupied hours. In the event that the system or portion of system is nonoperational during off-hour periods as a result of work of this contract, the Contractor must provide guard(s) to patrol the campus. Guard(s) and guard duties proposed by Contractor must be acceptable to District and District Police (local enforcement if District does not have its own Police Services). All costs for security guard(s) shall be Contractor's responsibility.

1.3 QUALITY ASSURANCE

A. Latest applicable publications listed below form a part of this Specification:

CEC	California Electrical Code
CFC	California Fire Code
NFPA 72	National Fire Alarm Code with California Amendments
ADA	Title 3 of the Americans with Disabilities Act
CCR	Titles 19 and 24 of the California Code of Regulations

1.4 CONTRACTOR QUALIFICATIONS

A. Fabricator/Installer/Vendor shall be licensed contractor and servicing agent, as well as installer for all components and systems in this System, and be acceptable to manufacturer of the major components of the system. Service personnel shall be capable of serving any and/or all components of the System.

B. Fabricator/Installer/Vendor must be able to present evidence of technical expertise, be a firm who has successfully installed projects of a similar scope to this project for a minimum of five (5) years, and shall maintain service office within 100 miles of the project site.

C. All equipment is to be manufactured by a firm/firms who have successfully fabricated elements/systems of a scope similar to this project for a minimum of ten (10) years.

D. Have a valid State of California Contractor's license in classification C10 - Electrical.

E. Provide authorized dealer service on-site at facility within four (4) hours of a problem being reported, with this response time available twenty-four (24) hours per day, seven (7) days per week.

F. Affirm that he maintains, or will maintain, or has access to, a stock of system spares sufficient to insure that no element of the System will be out of service for more than twenty-four (24) hours due to lack of proper spares.

1.5 SUBMITTALS, O&M'S AND RECORD DRAWINGS

A. Submittals:
1. Refer to Section 26 0000.
2. Contractor shall submit name of firm he proposes to do work under this Section, addresses, phone numbers, and name of firm's contact, for approval. Such firms shall be factory authorized representatives of the system and submittal shall include manufacturer's letter of confirmation. Proposed firm shall furnish all equipment and specialty cables, make all connections to same, and place the systems in operation. Such firms shall have offices and service departments within a 100 mile radius of project and shall have been in business of this type for at least five years.

3. Submittals shall be complete and include catalog data, shop drawings, one-line diagrams, battery calculations, voltage drop calculations, and scaled plan drawings. Building plans shall be 1/8"=1'-0", and site plans shall be no smaller than 1"=40'.
4. Shop Drawings shall contain complete wiring and schematic diagrams for equipment furnished, equipment layout, conduit and wiring layout drawings, and any other details required to demonstrate that system has been coordinated and will properly function as a unit. Equipment Vendor shall check Drawings for adequacy of conductors and raceways for proposed system. Include in Bid Amount all required raceways, conductors and material necessary to suit proposed system.

B. Operation and Maintenance Manuals:
1. Operating Instruction Manuals outlining the step-by-step procedures required for system start-up and operations shall be furnished. The instructions shall include manufacturer's name, model number, service manual parts list, and brief description of all equipment and their basic operating features.
2. Maintenance Instruction Manuals outlining maintenance procedures shall be furnished. The manual shall include a troubleshooting guide listing possible breakdowns and repairs and a simplified connection wiring diagram for the system as installed.

C. Record Drawings: Refer to Section 26 0000. Final Inspection will not be made until drawings are received and approved. Record Drawings shall include "As-Built" one-line and wiring diagrams, with terminations identified, wire color coding schedule, pullbox locations, and conduit routing plans.

D. Furnish to District a printed copy of the control panel programming upon completion of final system programming.

E. Performance Test Reports: Upon completion of installed system, submit in booklet form all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

1.6 TRAINING

A. Supplier shall demonstrate operation of systems and provide training to all end users, administrative staff, and system administrator. Coordinate times of instruction with District, at District’s convenience. Supplier shall provide a minimum of 1 hour of user instructions to clerical staff and 2 hours of user/maintenance instructions to District maintenance personnel. Instruction periods shall not coincide and shall be scheduled with District, not school staff. Deliver to Owner at time of demonstration, all settings and codes programmed into system. Furnish three copies on manufacturer’s standard programming worksheets. District shall provide list of authorized personnel for training sessions.

1.7 GUARANTEE

A. One firm to assume full responsibility for performance on all work of this section. Guarantee all equipment against defects in material and workmanship for two (2) years, and provide on-the-premises service during normal working hours for two years, at no cost to Owner if trouble is not caused by misuse, abuse, or accident, or at current labor rates if so caused. Provide manufacturer's written one-year guarantee for equipment and parts.

B. Service shall normally be available within 24 hours from service department of authorized distributor of manufacturer by factory trained servicemen.

C. On-the-premises service at other than normal working hours to also be available, but labor charges for such calls to be paid by Owner at current labor rates.

PART 2 - DETAIL REQUIREMENTS AND PRODUCTS

2.1 SYSTEM OPERATION

A. Activation of an intrusion alarm sensor shall cause a signal to be transmitted to a Central Station via telephone lines. Signal transmission shall be initiated by a built-in dialer unit. In addition to alarm reporting, system shall report trouble, low battery, and shunted zone indications.

2.2 SYSTEM DESCRIPTION

A. The system is existing.

2.3 ACCESSORIES

A. Equipment and accessories furnished under the terms of these specifications shall be the standard products of the manufacturers specified or required. All equipment shall be listed by U.L. All equipment and accessories shall be compatible with the system. Existing system is Bosch. The existing system manufacturer and model shall be verified by the contractor prior to ordering materials.

B. Keypads:

1. Keypads: Keypads shall match existing keypads on site.
2. Where surface conduit is used, provide keypad manufacturer’s surface mount box.

C. Room Detectors:

1. Wall or Ceiling Mounted: Shall match existing if currently available or currently available product compatible with existing system. Provide motion, glass-break, glass-break/microphone, or other device to match existing system protection type.
2. Provide wire guards at detectors in student toilet rooms, multi-purpose rooms, gymnasiums, locker rooms, team rooms and where called for on plans.

D. Door Contacts:

1. Entry Doors: Provide 1" diameter concealed steel door contact with magnet, off-white color, Tane Alarm SD-84C, DPDT (one pole to be used for EMS wiring).
2. Roof Access Hatches (RA): Provide surface mounted magnetic contacts with screw terminals, Sentrol 1045T.
3. Roll-Up Doors (RU): Provide surface mounted contact, Sentrol 2205AU.

E. Single Zone Multiplex Input Modules (Popits): Provide one for each detector. Provide one for each door contact, unless shown as grouped on plans.

F. Alarm Bells: 12V DC motor Bell and box, Amseco ABB-1033.

G. End of line resistors, as required.

H. Power Supplies: Altronics SMP Series with output voltage and capacity as required. Provide with appropriate transformer, enclosure(s), and battery(s). Battery(s) shall be sized to provide 24 hours of backup power. Provide power supplies as necessary.

PART 1 - EXECUTION

1.1 INSTALLATION REQUIREMENTS

A. Work shall be installed as shown on the Drawings in accordance with the manufacturer's diagrams and recommendations, except where otherwise indicated.

B. Electrical Contractor shall retain the services of the duly appointed representative as specified hereinbefore, who shall furnish all equipment, make all connections to same, and place system in operation. Technician and workman employed shall be particularly skilled in this type of work.

C. At existing sites, the existing system shall be tested as soon as possible after award of contract and prior to preparing submittals. Contractor shall test entire system to insure proper operation. Any defects of deficiencies found shall be listed and presented to Owner in letter form. It will be assumed that existing equipment is fully functional unless identified otherwise by Contractor.

D. Control panel shall be mounted with sufficient clearance for observation and testing.

E. All junction boxes must be clearly marked for distinct identification.

F. Panel enclosures shall comply with the Requirements of UL 864. Enclosures having doors over forty-eight inches (48") in height shall be provided with a three (3) point catch and lock; all other doors shall contain a cabinet type cylinder lock. Inserts shall be blind fastened so that no screws show on panel front.

G. Detectors shall be installed in accordance with manufacturer's written instructions in areas as indicated on the Drawings.

H. Circuits shall be terminated on screw terminals. Terminal blocks shall be Allen-Bradley Bulletin 1492 with 600 volt screw terminals for #22 to #10 conductors, mounted to type N22 channel, or approved equal. Submittal shall show internal elevation of terminal cabinets with equipment laid out.

I. All cables shall be run through fanning strip to terminals of terminal blocks.

J. All cables entering terminal cabinets and pullboxes shall be labeled.

K. Each cable run on as-built wiring diagrams shall be identified with exact wire marker code (numerical or alphabetical) as appears in terminal cabinets.

L. Detector locations shown on drawings are approximate only. Exact locations shall be coordinated with lighting and mechanical equipment and shall be placed in accordance with manufacturer's recommendations (with respect to supply air diffusers, etc.).

M. Station locations shall be identified by school’s actual room numbers and system shall be programmed accordingly. Coordinate actual room numbers with District. Coordinate final

programming with District. Contractor shall furnish a printed copy of final programming to District.

N. End-of-line resistors shall be installed at locations readily accessible, not above an elevation of 10 feet above finish floor or grade, or as shown on Drawings.

O. No splices shall occur in underground pullboxes. System wiring shall be continuous, without splices, from terminal cabinet to terminal cabinet and control panel to devices. All interior pullboxes shall be accessible and locations shall be recorded on "As-Built" drawings.

P. Door contacts shall be located 6" from strike side of door and both the switch and magnet shall be “glued” in place with clear silicone. Wiring shall enter door frame through jamb. Do not drill headers.

Q. Each detector installed in this contract shall have a popit. Each door contact installed in this contract shall have a popit, unless door contacts are shown grouped on drawings. In rooms with accessible ceilings, mount popit in junction box above ceiling. Where hard ceilings occur, provide flush box high on wall or on ceiling with blank finish plate. Wiring shall go to popits, then down to detectors.

R. Protected areas accessing remote keypads shall be wired and connected on delay zone, separate from all other protected areas.

S. After all equipment is installed and is operational, Intrusion Alarm System subcontractor shall set angle settings, sensitivity settings, etc., of each detector to insure optimum performance and minimal false alarms. Mask out areas of each motion type detector to remove sources of false alarms (windows, heaters, air diffusers, etc.) from detection zones.

1.2 CONSTRUCTION MEETINGS

A. The Contractor shall schedule construction meetings at the jobsite as follows:
   1. Pre-rough-in meeting shall occur before installation of any boxes, raceways, etc. Exact locations of all detectors shall be established as recommended by the Intrusion Alarm System subcontractor.
   2. Prewire meeting shall occur after raceways are installed and prior to pulling of any wire or cable.
   3. Pre-termination meeting shall occur after wire and cable has been installed and prior to termination.

B. Meetings shall be scheduled by the Contractor on a building by building basis and shall include the Project Inspector, School's Representative, the electrical subcontractor, and the Intrusion Alarm System subcontractor as a minimum.

C. One-half to three-quarters of the way through project, District Facilities will set up a meeting (preferably at the school site) with decision makers from Facilities, Police Services, Maintenance, Maintenance Alarm Tech, General Contractor, Alarm Sub-contractor, and School Administrator to review the alarm protocol and to identify responsible personnel and timelines.

1.3 TESTS

A. After all equipment specified herein has been installed and is in operating condition, performance tests shall be conducted to determine that installation and components comply with these specifications.
   1. Testing shall be scheduled by the Contractor and shall be conducted at time least disruptive to school activities and as approved by District. Contractor shall provide technicians to conduct all testing (from same firm preparing submittals and performing intrusion alarm work). Testing shall be coordinated to include the Project Inspector and a representative from Engineer's office.
   2. At time of testing, Contractor shall insure that his submittal will reflect all materials and work necessary to make new equipment function properly with existing.
   3. Contractor shall furnish all instruments and personnel required for tests.
   4. Conduct tests for following:
      a. Verify that the system is free of grounds or open circuits. The central control board shall indicate when a ground or open circuit exists.
      b. Verify that devices are functioning as specified.

B. Testing shall be reconducted to verify correction of any defect found in initial testing.

C. After system is completely tested, the Contractor shall take the following actions with the Owner:
   1. The Contractor will schedule a meeting with the Alarm Sub-contractors and Owner's Representatives to determine alarm zone and device nomenclature. The Contractor shall insure that the alarm zone and device nomenclature matches the actual building and door or room numbers used by the school. Architectural numbering shall not be used. Once confirmed, the Contractor shall demonstrate this to Owner's Representatives.

END OF SECTION 283100

SECTION 284600 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General Conditions and requirements of Division 1 and Section 26 0000 apply to work hereunder.

B. Furnish and install modifications to the existing Fire Alarm System including all wiring and connections and other materials as shown on Plans and specified herein. It is the intent that a complete operating system be installed and that any power supplies, relays, resistors, cards, modules, programming, or other items required to achieve this end result shall be furnished whether or not such item or items are specified herein.

C. Site and System Investigation: System bidder shall visit site prior to bid and become thoroughly knowledgeable about existing system and work required to perform work of this section. Failure to discover the equipment, materials, and labor required to complete the extensions will not relieve the contractor from completing the work at no additional cost.

1.2 GENERAL REQUIREMENTS

A. System Requirements: All of various equipment components to be complete with all appurtenant accessories required to provide specified facilities and perform specified functions throughout presently planned construction and space; and provisions for expanding system to provide same facilities, and perform same functions in all future planned construction, including space and mountings in control panels and terminal backboards.

B. Interruption of Service: Existing fire alarm system must be kept operational during work of this contract. If operation of existing system or portion of existing system is disrupted for connections into system or cutoff for any reason by work of this project, Contractor must provide fire watch. Fire watch must occur 24 hours per day and every day system is down. Fire watch proposed by Contractor must be acceptable to local fire authority and Owner. All costs for fire watch shall be Contractor’s responsibility.

1.3 QUALITY ASSURANCE:

A. Latest applicable publications listed below form a part of this Specification:

CEC	California Electrical Code
CFC	California Fire Code
NFPA 72	National Fire Alarm Code with California Amendments
ADA	Title 3 of the Americans with Disabilities Act
CCR	Titles 19 and 24 of the California Code of Regulations
CMC	Uniform Mechanical Code with California Amendments

1.4 CONTRACTOR QUALIFICATIONS:

A. Fabricator/Installer/Vendor shall be licensed contractor and servicing agent, as well as installer for all components and systems in this System, and be acceptable to manufacturer of the major

components of the system. Service personnel shall be capable of serving any and/or all components of the System.

B. Fabricator/Installer/Vendor must be able to present evidence of technical expertise, be a firm who has successfully installed projects of a similar scope to this project for a minimum of five (5) years, and shall maintain service office within 100 miles of the project site.

C. All equipment is to be manufactured by a firm/firms who have successfully fabricated elements/systems of a scope similar to this project for a minimum of ten (10) years.

D. Have a valid State of California Contractor's license in classification C10 - Electrical.

E. Provide authorized dealer service on-site at facility within four (4) hours of a problem being reported, with this response time available twenty-four (24) hours per day, seven (7) days per week.

F. Affirm that he maintains, or will maintain, or has access to, a stock of system spares sufficient to insure that no element of the System will be out of service for more than twenty-four (24) hours due to lack of proper spares.

1.5 SUBMITTALS, O&M'S AND RECORD DRAWINGS:

A. Submittals:
1. Refer to Section 26 0000.
2. Contractor shall submit name of firm he proposes to do work under this Section, addresses, phone numbers, and name of firm's contact, for approval. Such firms shall be factory authorized representatives of the system and submittal shall include manufacturer's letter of confirmation. Proposed firm shall furnish all equipment and specialty cables, make all connections to same, and place the systems in operation. Such firms shall have offices and service departments within a 100 mile radius of project and shall have been in business of this type for at least five years.
3. Submittals shall be complete and include catalog data, shop drawings, one-line diagrams, battery calculations, voltage drop calculations, and scaled plan drawings. Building plans shall be 1/8"=1'-0", and site plans shall be no smaller than 1"=40'.
4. Shop Drawings shall contain complete wiring and schematic diagrams for equipment furnished, equipment layout, conduit and wiring layout drawings, and any other details required to demonstrate that system has been coordinated and will properly function as a unit. Equipment Vendor shall check Drawings for adequacy of conductors and raceways for proposed system. Include in Bid Amount all required raceways, conductors and material necessary to suit proposed system.
5. Battery Capacity Calculations: Complete battery calculation sheet showing all the electrical requirements of the entire fire alarm system, including the power consumption of the individual devices, both in alarm and supervisory modes shall be submitted.
6. Voltage Drop Calculations: Submit voltage drop calculations for all fire alarm signal circuits.

B. Operation and Maintenance Manuals:
1. Operating Instruction Manuals outlining the step-by-step procedures required for system start-up and operations shall be furnished. The instructions shall include manufacturer's

name, model number, service manual parts list, and brief description of all equipment and their basic operating features.

2. Maintenance Instruction Manuals outlining maintenance procedures shall be furnished. The manual shall include a troubleshooting guide listing possible breakdowns and repairs and a simplified connection wiring diagram for the system as installed.

C. Record Drawings: Refer to Section 26 0000. Final Inspection will not be made until drawings are received and approved. Record Drawings shall include "As-Built" one-line and wiring diagrams, with terminations identified, wire color coding schedule, pullbox locations, and conduit routing plans.

D. Furnish to District a printed copy of the control panel programming upon completion of final system programming.

E. Performance Test Reports: Upon completion of installed system, submit in booklet form all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

1.6 TRAINING:

A. Supplier shall demonstrate operation of systems and provide training to all end users, administrative staff, and system administrator. Coordinate times of instruction with District, at District’s convenience. Supplier shall provide a minimum of 1 hour of user instructions to clerical staff and 2 hours of user/maintenance instructions to District maintenance personnel. Instruction periods shall not coincide and shall be scheduled with District, not school staff. Deliver to Owner at time of demonstration, all settings and codes programmed into system. Furnish three copies on manufacturer’s standard programming worksheets. District shall provide list of authorized personnel for training sessions.

1.7 GUARANTEE:

A. One firm to assume full responsibility for performance on all work of this section. Guarantee all equipment against defects in material and workmanship for two (2) years, and provide on-the-premises service during normal working hours for two years, at no cost to Owner if trouble is not caused by misuse, abuse, or accident, or at current labor rates if so caused. Provide manufacturer's written one-year guarantee for equipment and parts.

B. Service shall normally be available within 24 hours from service department of authorized distributor of manufacturer by factory trained servicemen.

C. On-the-premises service at other than normal working hours to also be available, but labor charges for such calls to be paid by Owner at current labor rates.

PART 2 - DETAIL REQUIREMENTS AND PRODUCTS

2.1 SYSTEM OPERATION

A. Activation of any manual station or automatic detector shall cause the operation of all audible and visual signals.

B. In addition to sounding local alarm signals, operation of manual stations or automatic detectors shall activate a digital communicator for telephone leased line reporting to remote SB575 compliant supervisory station. Telephone company leased lines and remote station monitoring shall be arranged by the Owner.

C. Contractor to ensure synchronization of visual devices where required by NFPA 72.

D. The system shall be electrically supervised against open circuits and grounds on the wiring to the alarm and initiating devices. An open or ground in the system shall cause a trouble signal to sound continuously until the system is restored to normal or until the signal is silenced by means of a cut-off switch. When the cut-off switch is thrown to the "off" position, a white pilot light shall be illuminated to show that the trouble signal is off. When the system is restored to normal operation, the trouble signal shall sound again and shall be silenced only by restoring the cut-off switch to its normal position, thereby also extinguishing the pilot light. Open and grounded circuits in the system shall not cause the sounding of false alarms. System shall be capable of initiating fire drill signal from master location. Fire drill signal shall not activate relay for remote reporting facilities.

2.2 MANUFACTURERS

A. Acceptable Manufacturers: Notifier

B. Requests for substitutions will be considered in accordance with provisions of section Division 1.

2.3 Fire Alarm Control Panel (FACP):

A. Fire Alarm Control Panel (FACP):
1. The main FACP Central Console shall be a NOTIFIER Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, control circuits, and notification appliance circuits, local and remote operator terminals, printers, annunciators, and other system controlled devices.
2. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
    a. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
    b. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
    c. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.
    d. Visually and audibly annunciate any trouble, supervisory, security or alarm condition on operator's terminals, panel display, and annunciators.

e. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
   1) The system alarm LED shall flash.
   2) A local piezo-electric audible device in the control panel shall sound a distinctive signal.
   3) The 640-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
   4) Printing and history storage equipment shall log and print the event information along with a time and date stamp.
   5) All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
   6) When a trouble condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
   7) The system trouble LED shall flash.
   8) A local piezo-electric audible device in the control panel shall sound a distinctive signal.
   9) The 640-character backlit LCD display shall indicate all information associated with the trouble condition, including the type of trouble point and its location within the protected premises.
   10) Printing and history storage equipment shall log and print the event information along with a time and date stamp.
   11) All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (trouble notification appliances and/or relays) shall be activated.

f. When a supervisory condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
   1) The system trouble LED shall flash.
   2) A local piezo-electric audible device in the control panel shall sound a distinctive signal.
   3) The 640-character backlit LCD display shall indicate all information associated with the supervisory condition, including the type of trouble point and its location within the protected premises.
   4) Printing and history storage equipment shall log and print the event information along with a time and date stamp.
   5) All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

g. When a security alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
   1) The system security LED shall flash.
   2) A local piezo-electric audible device in the control panel shall sound a distinctive signal.

3) The 640-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

4) Printing and history storage equipment shall log and print the event information along with a time and date stamp.

5) All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

h. When a pre-alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

1) The system pre-alarm LED shall flash.

2) A local piezo-electric audible device in the control panel shall sound a distinctive signal.

3) The 640-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

4) Printing and history storage equipment shall log and print the event information along with a time and date stamp.

5) All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

3. Operator Control:

a. Acknowledge Switch:

1) Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. In addition, the FACP shall support Block Acknowledge to allow multiple trouble conditions to be acknowledged with a single depression of this switch.

2) Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

b. Signal Silence Switch: Depression of the Signal Silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

c. Drill Switch: Depression of the Drill switch shall activate all programmed notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

d. System Reset Switch: Depression of the System Reset switch shall cause all electronically latched initiating devices to return to their normal condition. Initiating devices shall re-report if active. Active notification appliance circuits shall not silence upon Reset. Systems that de-activate and subsequently re-activate notification appliance circuits shall not be considered equal. All programmed Control-By-Event equations shall be re-evaluated after the reset sequence is

complete if the initiating condition has cleared. Non-latching trouble conditions shall not clear and re-report upon reset.

e. Lamp Test: The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

f. Scroll Display Keys: There shall be Scroll Display keys for FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. Depression of the Scroll Display key shall display the next event in the selected queue allowing the operator to view events by type.

g. Print Screen: Depression of the PRINT SCREEN switch shall send the information currently displayed on the 640-character display to the printer.

4. System Capacity and General Operation:

a. The control panel shall have four SLC modules. Each module shall support a maximum of 318 analog/addressable devices for a maximum system capacity of 1272 points. The system shall be capable of 3072 annunciation points per system regardless of the number of addressable devices.

b. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either the owner or installing company.

c. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

d. The FACP shall be able to provide the following software and hardware features:

1) Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

2) Smoke Detector Pre-Alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.

3) Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated,

4) Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.

5) The system shall support a detector response time to meet world annunciation requirements of less than three seconds.

6) Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.

7) NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meet the requirements of NFPA 72.

8) Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.

9) On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line, the system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop.

10) History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.

11) Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.

12) The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.

13) Drill: The system shall support means to activate all silenceable fire output circuits in the event of a practice evacuation or "drill". If enabled for local control, the front panel switch shall be held for a minimum of two seconds prior to activating the drill function.

14) Passwords and Users: The system shall support two password levels, master and user. Up to nine user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.

15) Two Wire Detection: The system shall support standard two wire detection devices, specifically all models of System Sensor devices, Fenwal PDS-7125/7126 and CPD-7021, Hochiki model SLK-24F/24FH, Edwards 6250B/6270B and 6264B and Simplex models 2098-9201/9202 and 9576.

16) Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions.

17) Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.

18) Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

19) Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.

20) Print Functions: The system shall provide means to obtain a variety of reports listing all event, alarm, trouble, supervisory, or security history. Additional reports shall be available for point activation for the last Walk Test performed, detector maintenance report containing the detector maintenance status of each installed addressable detector, all network parameters, all panel settings including broad cast time, event ordering, and block acknowledge, panel timer values for Auto Silence, Silence Inhibit, AC Fail Delay time and if enabled, Proprietary Reminder, and Remote Reminder timers, supervision settings for power supply and printers, all programmed logic equations, all custom action messages, all non-fire and output activations (if pre-programmed for logging) all active points filtered by alarms only, troubles only, supervisory alarms, pre-alarms, disabled points and activated points, all installed points filtered by SLC points, logic zones, annunciators, releasing zones, special zones, and trouble zones.

21) Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.

22) Resound based on type for security or supervisory: The system shall indicate a Security alarm when a monitor module point programmed with a security Type Code activates. If silenced alarms exist, a Security alarm will resound the panel sounder. The system shall indicate a Supervisory alarm when a monitor module point programmed with a supervisory Type Code activates. If there are silenced alarms, a Supervisory alarm will resound the panel sounder.

23) Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.

24) Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.

25) Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector to up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result or product of all cooperating detectors chamber readings.

26) Tracking/Latching Duct (ion and photo): The system shall support both tracking and latching duct detectors either ion or photo types.

27) Active Event: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.

28) Non-Fire Alarm Module Reporting: A point with a type ID of Non-Fire shall be available for use for energy management or other non-fire situations. Non-Fire point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a Non-Fire point shall activate control by event logic but shall not cause any indication on the control panel.

29) Security Monitor Points: The system shall provide means to monitor any point as a type security.

30) One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

31) Control by Event (CBE) Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.

32) Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.

33) 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.

34) 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.

35) 10 trouble equations per device: The system shall provide support for up to 10 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.

36) Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24-hour time schedule on any day of the week or year.

37) Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

38) Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector or indicating panel module input. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

5. Central Processing Unit:

a. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the Central Processing Unit.

b. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANY x, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.

c. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

d. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.

e. Consistent with UL864 standards, the CPU and associated equipment are to be protected so that voltage surges or line transients will not affect them.

f. Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.

g. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.

h. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.

i. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

j. The CPU shall provide one high-speed serial connection for support of network communication modules.

k. The CPU shall provide double pole relays for FIRE ALARM, SYSTEM TROUBLE, SUPERVISORY, and SECURITY. The SUPERVISORY and SECURITY relays shall provide selection for additional FIRE ALARM contacts.

l. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

6. System Display:

a. The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

b. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.

c. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide ten Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, and CPU FAILURE.

d. The system display shall provide a QWERTY style keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

e. The system display shall include the following operator control switches: ACKNOWLEDGE, SIGNAL SILENCE, RESET, DRILL, and LAMP TEST. Additionally, the display interface shall allow scrolling of events by event type including, FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. A PRINT SCREEN button shall be provided for printing the event currently displayed on the 640-character LCD.

7. Loop (Signaling Line Circuit) Control Module:

a. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.

b. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.

c. The Loop Control Module shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be capable of operating as a NFPA Style 6 (Class B) circuit.

d. The SLC interface board shall be able to drive an NFPA Style 6 twisted unshielded circuit up to 12,500' in length. The SLC Interface shall also be capable of driving an NFPA Style 6, no twist, no shield circuit for limited distances determined by the manufacturer. In addition, SLC wiring shall meet the listing requirements for it to exit the building or structure. "T"-tapping shall be allowed in either case.

e. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

8. Enclosures:
   a. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
   b. The back box and door shall be constructed of 0.060" steel with provisions for electrical conduit connections into the sides and top.
   c. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
   d. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.
9. Digital Voice Command Center:
   a. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
   b. Function: The Voice Command Center equipment shall perform the following functions:
      1) Operate as a supervised multi-channel emergency voice communication system.
      2) Operate as a two-way emergency telephone system control center.
      3) Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
      4) Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
      5) Provide all-call Emergency Paging activities through activation of a single control switch.
      6) As required, provide vectored paging control to specific audio zones via dedicated control switches.

7) Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.

8) Provide a software utility capable of off-line programming for the VCC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the VCC shall not inhibit the emergency operation of other nodes on the fire alarm network.

9) Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SCL controlled switching.

10) The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.

11) The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

10. Power Supply:
    a. The Addressable Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
    b. The Addressable Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
    c. The Addressable Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 Ah within a 48-hour period.
    d. The Addressable Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
    e. The Addressable Main Power Supply shall be power-limited per UL864 requirements.
11. Field Charging Power Supply (FCPS): The FCPS is a device designed for use as either a remote 24V power supply or used to power Notification Appliances.
    a. The FCPS shall offer up to 6.0A (4.0A continuous) of regulated 24V power. It shall include an integral charger designed to charge 7.0 Ah batteries and to support 60-hour standby.
    b. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
    c. The FCPS shall include an attractive surface mount backbox.
    d. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
    e. The FCPS include power limited circuitry, per 1995 UL standards.
12. System Circuit Supervision:

a. The FACP shall supervise all circuits to intelligent devices, transponders, annunciators and peripheral equipment and annunciate loss of communication with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information in the history buffer and on the printer.

b. Transponders that lose communication with the CPU shall sound an audible trouble and light an LED indicating loss of communications.

c. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.

d. All speaker and emergency phone circuits shall be supervised for opens and shorts. Each transponder speaker and emergency phone circuit shall have an individual ON/OFF indication (green LED).

13. Field Wiring Terminal Blocks: All wiring terminal blocks shall be the plug-in/removable type and shall be capable of terminating up to 12 AWG wire. Terminal blocks that are permanently fixed to the PC board are not acceptable.

14. Audio Amplifiers:

a. The Audio Amplifiers will provide Audio Power (@25V RMS) for distribution to speaker circuits.

b. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).

c. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:

1) Earth Fault on DAP A (Digital Audio Port A)
2) Earth Fault on DAP B (Digital Audio Port B)
3) Audio Amplifier Failure Detected Trouble
4) Active Alarm Bus input
5) Audio Detected on Aux Input A
6) Audio Detected on Aux Input B
7) Audio Detected on Firefighter's Telephone Riser
8) Receiving Audio from digital audio riser
9) Short circuit on speaker circuit 1
10) Short circuit on speaker circuit 2
11) Short circuit on speaker circuit 3
12) Short circuit on speaker circuit 4
13) Data Transmitted on DAP A
14) Data Received on DAP A
15) Data Transmitted on DAP B
16) Data Received on DAP B
17) Board failure
18) Active fiber optic media connection on port A (fiber optic media applications)
19) Active fiber optic media connection on port B (fiber optic media applications)

20) Power supply Earth Fault
21) Power supply 5V present
22) Power supply conditions: Brownout, High Battery, Low Battery, Charger Trouble

d. The audio amplifier shall provide the following built-in controls:
1) Amplifier Address Selection Switches
2) Signal Silence of communication loss annunciation Reset
3) Level adjustment for background music
4) Enable/Disable for Earth Fault detection on DAP A
5) Enable/Disable for Earth Fault detection on DAP A
6) Switch for 2-wire/4-wire FFT riser

e. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.

f. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).

g. System shall be capable of backing up digital amplifiers.

h. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.

i. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.

j. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier car

15. Audio Message Generator (Prerecorded Voice)/Speaker Control:
a. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.

b. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four times. Pre- and post-message tones shall be supported.

c. A built-in microphone shall be provided to allow paging through speaker circuits.

d. System paging from emergency telephone circuits shall be supported.

e. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
1) LED Indicators:
a) Lamp Test
b) Trouble
c) Off-Line Trouble
d) Microphone Trouble
e) Phone Trouble
f) Busy/Wait
g) Page Inhibited
h) Pre/Post Announcement Tone

16. Controls with associated LED Indicators:
    a. Speaker Switches/Indicators:
        1) The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
        2) The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
    b. Emergency Two-Way Telephone Control Switches/Indicators:
        1) The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
        2) The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.
17. Remote Transmissions:
    a. Provide local energy or polarity reversal or trip circuits as required.
    b. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
    c. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
    d. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.
18. System Expansion: Design the main FACP and required components so that the system can be expanded in the future (to include the addition of twenty percent more circuits or zones) without disruption or replacement of the existing control panel. This shall include hardware capacity, software capacity and cabinet space.
19. Field Programming:
    a. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
    b. It shall be possible to program through the standard FACP keyboard all system functions.
    c. All field defined programs shall be stored in non-volatile memory.
    d. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five digits at a minimum. Upon entry of an invalid password for the third time within a one-minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.
    e. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.

f. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

20. Specific System Operations:
    a. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.
    b. Alarm Verification: Each of the Intelligent Addressable Smoke Detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification function shall be programmable from 5 to 50 seconds and each detector shall be able to be selected for verification during the field programming of the system or any time after system turn-on. Alarm verification shall not require any additional hardware to be added to the control panel. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
21. System Point Operations:
    a. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
    b. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
    c. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
        1) Device Status.
        2) Device Type.
        3) Custom Device Label.
        4) Software Zone Label.
        5) Device Zone Assignments.
        6) Analog Detector Sensitivity.
        7) All Program Parameters.
    d. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system statuses:
    e. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printer history events shall include all alarms, troubles, operator actions, and programming entries.

f. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.

g. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.

h. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

i. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

B. Fixed Emergency Telephone Handset:

1. The telephone cabinet shall be painted red and clearly labeled as "Emergency Telephone." The cabinets shall be located where shown on drawings.

2. The handset cradle shall have a switch connection so that lifting the handset off of the cradle shall send a signal to the fire command center, which shall audibly and visually indicate its on-line (off-hook) condition.

3. On activating the remote phone, the phone earpiece shall sound a telephone ring signal until the master handset is lifted.

4. The two-way emergency telephone system shall support a minimum of seven handsets on line without degradation of the signal.

C. Universal Digital Alarm Communicator Transmitter (UDACT): The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000' from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.

2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.

3. The UDACT shall be completely field programmable from a built-in keypad and 4-character red, seven segment display.

4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.

5. Communication shall include vital system status such as:

a. Independent Zone (Alarm, trouble, non-alarm, supervisory)

b. Independent Addressable Device Status

c. AC (Mains) Power Loss

d. Low Battery and Earth Fault

e. System Off Normal
f. 12 and 24 Hour Test Signal
g. Abnormal Test Signal (per UL requirements)
h. EIA-485 Communications Failure
i. Phone Line Failure

6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
7. AN IP Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet to a compatible receiver.

2.4 ACCESSORIES

A. Equipment and accessories furnished under the terms of these specifications shall be the standard products of the manufacturers specified or required. All equipment shall be listed by U.L. All equipment and accessories shall be compatible with the system.

B. Refer to drawings for accessories and devices used.

C. Manual stations shall conform to DSA Access Compliance requirements. Operation of the manual station shall not require grasping of the handle.

D. Each manual station shall be provided with a clear protective cover, non locking, STI-1200 (flush mount) or STI-1230 (surface mount). Covers shall not be equipped with horn.

E. Each duct detector shall be provided with a key-activated remote test station.

F. At ceilings other than lay-in ceilings, provide access doors in ceiling directly below above-ceiling mounted detectors. Access doors shall be KARP, Milcor, Newman, or approved equal, with concealed hinges, prime coated with rust inhibitive paint, screwdriver locks at interior and key operated cylinder locks at exterior locations. Style of door shall suit ceiling or wall construction, including fire rating. Doors shall be 14 gauge C.R. steel minimum.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Work shall be installed as shown on the Drawings in accordance with the manufacturer's diagrams and recommendations, except where otherwise indicated.

B. Electrical Contractor shall retain the services of the duly appointed representative as specified hereinbefore, who shall furnish all equipment, make all connections to same, and place system in operation. Technician and workman employed shall be particularly skilled in this type of work.

C. At existing sites, the existing system shall be tested as soon as possible after award of contract and prior to preparing submittals. Contractor shall test entire system to insure proper operation. Any defects of deficiencies found shall be listed and presented to Owner in letter form. It will be

assumed that existing equipment is fully functional unless identified otherwise by Contractor. Control panel shall be mounted with sufficient clearance for observation and testing.

D. All junction boxes must be clearly marked for distinct identification.

E. Panel enclosures shall comply with the Requirements of UL 864. Enclosures having doors over forty-eight inches (48") in height shall be provided with a three (3) point catch and lock; all other doors shall contain a cabinet type cylinder lock. Inserts shall be blind fastened so that no screws show on panel front.

F. Detectors shall be installed in accordance with manufacturer's written instructions in areas as indicated on the Drawings.

G. Locate detectors with pilot light visible from floor. Do not conceal behind HVAC duct work.

H. Do not locate detectors in direct air stream from supply air outlets (minimum of four feet (4') from air grille).

I. At locations other than t-bar ceilings, provide access door in ceiling directly below above-ceiling mounted detectors.

J. Circuits shall be terminated on screw terminals. Terminal blocks shall be Allen-Bradley Bulletin 1492 with 600 volt screw terminals for #22 to #10 conductors, mounted to type N22 channel, or approved equal. Submittal shall show internal elevation of terminal cabinets with equipment laid out.

K. All cables shall be run through fanning strip to terminals of terminal blocks.

L. All cables entering terminal cabinets and pullboxes shall be labeled.

M. Each cable run on as-built wiring diagrams shall be identified with exact wire marker code (numerical or alphabetical) as appears in terminal cabinets.

N. Detector locations shown on drawings are approximate only. Exact locations shall be coordinated with lighting and mechanical equipment and shall be placed in accordance with manufacturer's recommendations (with respect to supply air diffusers, etc.).

O. Detectors and notification devices in student toilet rooms, multi-purpose rooms, gymnasiums, locker rooms, team rooms and where shown on plans shall be provided with wire guards.

P. Station locations shall be identified by school’s actual room numbers and system shall be programmed accordingly. Coordinate actual room numbers with District. Coordinate final programming with District. Contractor shall furnish a printed copy of final programming to District.

Q. End-of-line resistors shall be installed at locations readily accessible, not above an elevation of 10 feet above finish floor or grade, or as shown on Drawings.

R. No splices shall occur in underground pullboxes. System wiring shall be continuous, without splices, from terminal cabinet to terminal cabinet and control panel to devices. All interior pullboxes shall be accessible and locations shall be recorded on "As-Built" drawings.

3.2 DUCT DETECTOR REMOTE TEST STATIONS

A. Each duct detector shall be provided with a key-activated remote test station. If not shown on plans, locate test switch approximately below duct detector and 6" below ceiling (at ceilings or roof structures higher than 10', install test station at +9'-6". Provide 3/4" conduit with cable as required by manufacturer to connect test station to detector.

3.3 DIGITAL COMMUNICATOR

A. From communicator in FACP, provide a 1" conduit with two 4-wire, 22 gauge telephone cables to the main telephone terminal backboard. Connect at communicator and at telephone backboard on surface mounted RJ31X jacks.

B. Contractor shall program the communicator to transmit alarm and trouble per device and module.

C. Contractor shall provide communicator zone/point information and other items listed hereinbefore to District's central station. Coordinate with District.

3.4 ACCESS DOORS

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of fire alarm detectors above ceilings. Access doors shall be sized to allow access to equipment for complete removal and replacement of device.

3.5 CONSTRUCTION MEETINGS

A. The Contractor shall schedule construction meetings at the jobsite as follows:
   1. Pre-rough-in meeting shall occur before installation of any boxes, raceways, etc. Exact locations of all detectors shall be established as recommended by the Intrusion Alarm System subcontractor.
   2. Prewire meeting shall occur after raceways are installed and prior to pulling of any wire or cable.
   3. Pre-termination meeting shall occur after wire and cable has been installed and prior to termination.

B. Meetings shall be scheduled by the Contractor on a building by building basis and shall include the Project Inspector, School's Representative, the electrical subcontractor, and the Intrusion Alarm System subcontractor as a minimum.

C. One-half to three-quarters of the way through project, District Facilities will set up a meeting (preferably at the school site) with decision makers from Facilities, Police Services, Maintenance, Maintenance Alarm Tech, General Contractor, Alarm Sub-contractor, and School Administrator to review the alarm protocol and to identify responsible personnel and timelines.

3.6 TESTS

A. After all equipment specified herein has been installed and is in operating condition, performance tests shall be conducted to determine that installation and components comply with these specifications.
   1. Testing shall be scheduled by the Contractor and shall be conducted at time least disruptive to school activities and as approved by District. Contractor shall provide technicians to

conduct all testing (from same firm preparing submittals and performing intrusion alarm work). Testing shall be coordinated to include the Project Inspector and a representative from Engineer's office.

2. At time of testing, Contractor shall insure that his submittal will reflect all materials and work necessary to make new equipment function properly with existing.
3. Contractor shall furnish all instruments and personnel required for tests.
4. Conduct tests for following:
    a. Verify that the system is free of grounds or open circuits. The central control board shall indicate when a ground or open circuit exists.
    b. Verify that notification devices, pull stations, transmitters, automatic detectors and supervisory devices are functioning as specified. Criteria for testing shall be as follows:
        1) Audibles shall deliver the sound pressure levels (decibels) of the specified device.
        2) Pull stations shall close the circuits specified and deliver specified alarm signal.
        3) Automatic detectors shall actuate the specified zones when the appropriate fire or smoke conditions are generated.
            a) Calibrate and adjust all photoelectric detectors to manufacturer's standards in place and under dynamic field operating conditions using testing equipment built by manufacturer specifically for this purpose.
    c. Panels and supervisory devices shall display and control functions as specified.
5. The "End of Line Resistance" for each circuit shall be tested in the presence of the project inspector and shall not exceed a maximum of 10% of the 24 volt system. Each component in the circuit shall not exceed the listed manufacturer's minimum operating voltages. See NFPA 72, loop resistance. This section requires that all initiating and indicating (notification appliance) circuits to be measured and recorded.
6. The actual fire alarm notification circuit voltage drop shall be witnessed and recorded by the project inspector during the testing of the circuit under full load.

B. Testing shall be performed under the supervision of Fire Alarm System supplier's qualified representative.

C. Testing shall be reconducted to verify correction of any defect found in initial testing.

D. Upon completion of detector installation and system tests, certified technician shall submit three (3) copies of written report on manufacturer's Inspection and Test Forms to indicate system has been fully tested in supervision, trouble and alarm modes, and is fully operational conforming to letter of these Specifications.
1. Test report shall contain, but is not limited to, the following:
    a. A complete test of equipment installed and wired.
    b. Indication that all equipment is properly installed.
    c. Tests of individual zones as applicable.
    d. Serial numbers, locations by zone and model number for each installed detector.
    e. Voltage (sensitivity) settings for each photoelectric detector as measured in place with the air conditioning system operating.

f. Technician's name, certificate number, and date.

g. Written certification by manufacturer stating that system and its component parts are as listed and approved by California State Fire Marshal and that installation conforms in all respects to requirements of applicable Codes.

E. After system is completely tested, the Contractor shall take the following actions with the Owner:
1. The Contractor will schedule a meeting with the Alarm Sub-contractors and Owner's Representatives to determine alarm zone and device nomenclature. The Contractor shall insure that the alarm zone and device nomenclature matches the actual building and door or room numbers used by the school. Architectural numbering shall not be used. Once confirmed, the Contractor shall demonstrate this to Owner's Representatives.

3.7 FIRE ALARM SYSTEM CERTIFICATION

A. Fire Alarm System Certification: Written certification on the form found in Figure 10.18.2.1.1, NFPA 72 shall be submitted by the Contractor to Project Inspector stating for himself and the equipment manufacturer that component parts are as LISTED AND APPROVED BY State Fire Marshal, that the installation conforms in all respects to requirements as set forth in the California Electrical Code, that acceptance testing has been performed in the presence of the Project Inspector. Contractor shall complete and sign form and submit to Project Inspector.

END OF SECTION 284600

SECTOPM 31 00 00 – EARTHWORK

PART 1 - GENERAL

1.1 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

B. Section 01 57 13, Erosion Control

C. Section 31 23 33, Trenching and Backfilling.

D. Section 32 12 00, Asphalt Concrete Paving.

E. Section 32 16 00, Site Concrete.

F. Section 33 40 00, Site Drainage.

1.3 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting of inadequate compaction or moisture content is the sole responsibility of the contractor.

D. Tests (See Part 3 for Compaction Testing).

E. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the contractor. Contractor shall be solely responsible for any and all repairs.

1.4 SUBMITTALS

A. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and

maintenance instructions.

1.5 WARRANTY

A. Refer to General Conditions.

1.6 REFERENCES AND STANDARDS

A. General: Site survey, included in the drawings, was prepared by Warren Consulting Engineers, Inc. and is the basis for data regarding current conditions. While the survey is deemed generally accurate, there exists discrepancies and variations due to elapsed time, weather, etc. Existing dirt grades may vary 0.2 ft. from that shown.

B. Geotechnical Engineering Report was prepared by Geocon Consultants, Inc. Report is entitled Geotechnical Investigation and Geologic Hazards Eveluation, and is on file with Architect. Recommendations of the Goetechnical report were used to develop the contract plans and specifications. The Geotechnical report shall be used as a reference for the soil condition of the project site. The design information contained in the contract plans and specifications shall govern over the recommendation of the Geotechnical report.

C. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.

D. ASTM International (ASTM):
1. D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
2. D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
3. D1557-12E1 - 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.
4. D3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
5. D422-63(2007) e1 Test Method for Particle Size Analysis of Soil.
6. D4318-17E1 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

E. CALTRANS Standard Specifications Section 17.

F. CAL-OSHA, Title 8, Section 1590 (e).

G. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction and shall not begin until all of those governing authorities have been notified.

1.7 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.8 PROJECT CONDITIONS

A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.

B. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.9 EXISTING SITE 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.

1.10 ON SITE UTILITY VERIFICATION AND REPAIR PROCEDURES

A. Ground-breaking requirements:
   1. All underground work performed by a Contractor must be authorized by the District's Construction Manager or the Low Voltage Consultant prior to start of construction.
   2. The Contractor is to obtain and keep the original School's construction utility site plans on site during all excavation operations. Contractor can contact the District's Construction Manager, Facilities Manager, or the Low Voltage Consultant to procure the drawings.

B. Underground Utility Locating:
   1. The contractor shall hire an Underground Utility Locating Service to locate existing underground utility pathways in areas affected by the scope of work for excavation.
   2. Contractor must use an underground utility locator service with a minimum of 3 years' experience. The equipment operator must have demonstrated experience.
   3. The Underground Utility Locator Service must have the use of equipment with the ability to locate by means of inductive clamping, induction, inductive metal detection, conductive coupling, or TransOnde (Radio detection) to generate signals, passive locating (free scoping) for "hot" electric, and metal detector.
   4. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72".
   5. The Underground Utility Locator Service must be able to locate but are not limited to locating the following types of utility pathways:
      a) All conduit pathways containing 110 volt or greater 50-60Hz electrical wire.
      b) All conduit pathways containing an active cable TV system.
      c) All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.
      d) All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.

e) All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.
f) All plastic and other nonconductive water lines in which a TransOnde Radio detection) or other "transmitter" can be applied to create a low frequency pressure waive (signal) without damaging or triggering the existing systems
g) All copper or steel waterlines and plastic or steel gas lines

6. All markings made by the Underground Utility Locator Service or other shall be clear and visible.
7. The contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.
8. The Underground Utility Locator Service shall provide the contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to permanent buildings. Contractor will deliver one copy to the district at no additional charge.
9. Contractor is responsible to contact Underground Service Alert (U.S.A. 800/227-2600) and receive clearance prior to any excavation operations.
10. Contractor shall inform the (District's Construction Manager) (Architect) (Owner) no later than five (5) days prior to the date scheduled for the utility locator service to be on site.

1.11 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, the Contractor shall be solely and completely responsible for working conditions at the job site, 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. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The 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.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. 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.

1.12 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

B. Excessively wet fill material shall be bladed and aerated per section 3.08, B.

1.13 TESTING

A. General: Refer to Quality Requirements.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.
   1. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.
   2. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

1.14 ARCHEOLOGICAL AND CULTURAL RESOURCES

A. If archeological or cultural resources are discovered during the Work, the Contractor must cease all construction operations in the vicinity of the discovery until a qualified archeologist can assess the value of these resources and make recommendations to the State Historic Preservation Officer. Archeological and cultural resources include artifacts, large amounts of bone, shell, or flaked stone, and other evidence of human activity. If the State Historic Preservation Officer or the Owner directs that work be temporarily ceased at the location of an archeological or cultural find, the Contractor must temporarily suspend work at the location.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Engineered Fill Materials: All fill shall be of approved local materials supplemented by imported fill if necessary. "Approved" local materials are defined as local soils tested and approved by Geotechnical Engineer free from debris, and concentrations of clay and organics; and contain rocks no larger than 3-inches in greatest dimension. The soil and rock should be thoroughly blended so that all rock is surrounded by soil. This may require mixing of the soil and rock with a dozer prior to placement and compaction. Clods, rocks, hard lumps or cobbles exceeding 3-inches in final size shall not be allowed in the upper 12 inches of any fill. Native clay or clayey soils will not be permitted within the upper 12 inches of building pad areas or paved areas.

B. Imported Engineered Fill Material: Imported fill may be required to complete work. Proposed

import fill material shall meet the above requirements; shall be similar to the native soils. Import fill shall meet the above requirements; shall have plasticity index of 15 or less; a Liquid limit less than 50; an Expansion Index of 20 or less; be free of particles greater than 3-inches in largest dimension; be free of contaminants and have corrosion characteristics within the acceptable limits. All import fill material shall be tested and approved by Soils Engineer prior to transportation to the site. Proposed fill material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.

1. DTSC TESTING: Site work contractor is to coordinate testing with an analytical lab, hired by the owner, licensed by the State of California for the DTSC testing. The costs associated with the testing will be paid by the contractor.
2. DTSC testing shall include documentation as to the previous land use, location, and history. Soils shall be analyzed for all compounds of concern to ensure the imported soil is uncontaminated and acceptable. Testing shall be performed per the recommendations included in DTSC Imported Fill Advisory http://www.dtsc.ca.gov/Schools/upload/SMP FS Cleanfill-Schools.pdf). Soils shall be tested prior to import to the project site.
   Lab shall determine geographically which tests and analysis comparison will be appropriate for the testing. (CAM 17 / Title 22); (RWQCB) Regional Water Quality Control Board; or (OEHHA) Office of Environmental Health Hazard Assessment.
3. Frequency of testing shall be conducted in accordance with DTSC's Imported Fill Advisory as follows;

Fill Material Sampling Schedule Area of Individual Borrow Area	Sampling Requirements
2 Acres or less	Minimum of 4 samples
2 to 4 Acres	Minimum of 1 sample every ½ Acre
4 to 10 Acres	Minimum of 8 Samples
Greater than 10 Acres	Minimum of 8 locations with 4 subsamples per location
Volume of Borrow Area Stockpile	
Up to 1,000 Cubic Yards	1 sample per 250 cubic yards
1,000 to 5,000 Cubic Yards	4 samples for the first 1000 cubic Yards + 1 sample per each additional 500 cubic yards
Greater than 5,000 Cubic Yards	12 samples for the first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

4. Reports/ Documentation
   a. Results of the testing analysis shall be sent to the Owner; Architect; Project Inspector, Project Civil Engineer, DTSC, and DSA. Letter shall reference DSA file and application numbers.

C. Landscape Backfill Material:
1. The top 4" of native topsoil stripped from the site in previously landscape areas may be used for landscape backfill material.
2. Imported Topsoil may be required to complete work. Proposed Topsoil material shall

comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.

D. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

E. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as specified in Cal Trans Standard Specifications, Section 26,-1.02A.

F. Decomposed Granite: Decomposed Granite shall be well graded mixture of fine to 1/8" particles in size with no clods. The material shall be free of vegetation, other soils, debris and rock. The material shall be reddish-tan to tan in color.

G. Decomposed Granite Solidifier: PolyPavement or equal.

PART 3 – EXECUTION

3.1 INSPECTION LAYOUT AND PREPARATION

A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence

B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.

C. Verify that specified items may be installed in accordance with the approved design.

D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.2 PERFORMANCE

A. GENERAL:
1. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
2. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Architect for notification of appropriate authorities.
3. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density determined by ASTM D1557 Compaction Test method, and such expressed percentage thereof will be minimum acceptable compaction for specified work.

4. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.3 DEMOLITION, DISPOSAL AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 12", moisture-conditioned to optimum moisture content, and recompacted to at least 90% of the maximum dry density.

3.4 TESTING AND OBSERVATION

A. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.

B. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.

C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

D. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.

E. After each rain event Geotechnical Engineer shall test fill material for optimum moisture. Do not place any fill material until desired moisture is achieved.

3.5 CLEARING AND GRUBBING

A. Prior to grading, remove all debris off-site. Remove trees and brush including the root systems. oles resulting from tree and brush removal should be prepared and backfilled in accordance with paragraphs 3.07, 3.08, 3.09, and 3.10. This may require deepening and/or widening the holes to adequately remove disturbed soil and provide room for compaction equipment. Strip the surface of all organics.

3.6 CUTTING

A. Do all cutting necessary to bring finish grade to elevations shown on Drawings.

B. When excavation through roots is necessary, cut roots by hand.

C. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.

3.7 STRUCTURAL EXCAVATION

A. General: Excavate to bear on firm material at contract depth shown on Structural Drawings.

B. Footings: All footing excavations shall be of sufficient width for installation of formwork, unless earth will retain its position during concreting. All portions of footings above grade must be formed.

C. Unsuitable Ground: Any errors in structural excavation, soft ground, or clay soils found when excavating shall be reported to Architect. In no case shall work be built on any such soft or clayey unsuitable surface without direction from the Architect. Restore excavations to proper elevation with engineered fill material compacted to 90% of dry density.

3.8 SUBGRADE PREPARATION

A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05' of grades indicated.

B. After clearing, grubbing and cutting, subsurface shall be plowed or scarified to a depth of at least 12", until surface is free from ruts, hummocks or other uneven features and uniform and free from large clods. Moisture condition to optimum moisture content and recompact to at least 90% of the maximum dry density as determined by ASTM Test Method D1557. If the existing soils are at a water content higher than specified, the contractor shall provide multiple daily aerations by ripping, blading, and/or disking to dry the soils to a moisture content where the specified degree of compaction can be achieved. After seven consecutive working days of daily aerations, and the moisture content of the soil remains higher than specified, the contractor shall notify the architect. If the existing soils have a moisture content lower than specified, the contractor shall scarify, rip, water and blade existing soil to achieve specified moisture content. The contractor shall make proper allowance in schedule and methods to complete this work.

C. Subgrade in areas to receive landscaping shall be compacted to 90%.

D. Where Contractor over-excavates building pads through error, resulting excavation shall be recompacted as engineered fill at Contractor's expense.

3.9 PLACING, SPREADING AND COMPACTING FILL MATERIAL IN BUILDING PAD AND PAVEMENT AREAS

A. Selected fill material shall be placed in layers which, when compacted, shall not exceed 6 inches in compacted thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity

in moisture content.

B. Selected fill material shall be moisture-conditioned to specified moisture content. Selected fill material shall be unfrozen. When moisture content of fill material is below that specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading or other methods mentioned in 3.08 B until moisture content is satisfactory.

C. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to a minimum of 90% as determined by the ASTM D1557 Compaction Test. Compact each layer over its entire area until desired density has been obtained.

D. Recompaction of Fill in Trenches and Compaction of Fill Adjacent to Walls: Where trenches must be excavated, backfill with material excavated. Place in lifts that when compacted do not exceed 8", moisture conditioned to optimum moisture content, and compact to a minimum of 90% relative compaction in building pad and paved areas, and to 90% relative compaction in landscape areas.

E. Jetting of fill materials will not be allowed.

3.10 FINAL SUBGRADE COMPACTION

A. Building Pads: Upper 12" of all final building pad subgrades (including future buildings) shall be uniformly compacted at 2% above optimum moisture content to at least 90% of maximum dry density, as determined by ASTM D1557 Compaction Test, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.

B. Paved Areas: Upper 6" of all final subgrades supporting pavement sections and all other flatwork shall be brought to 2% above optimum moisture content and shall be uniformly compacted to not less than 95% of maximum dry density, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.

C. Other Fill and Backfill: Upper 6" of all other final subgrades or finish grades shall be compacted to 90% of maximum dry density.

D. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

3.11 PLACING, SPREADING, AND COMPACTION OF LANDSCAPE BACKFILL MATERIALS

A. All landscaped areas shall receive topsoil. After subgrade under landscape area has been scarified and brought to 90% maximum dry density, top soil shall be placed evenly to depth of 6" at 85% of maximum dry density.

B. Project Inspector must verify that materials are uniformly spread to minimum depth specified.

3.12 DECOMPOSED GRANITE COMPACTION AND STABILIZATION

A. Decomposed granite paving, paths or track shall be placed uniformly to the required depth and treated with PolyPavement or approved equal. Apply PolyPavement using Application Method 1 or a mixed application method.

3.13 SLOPE CONSTRUCTION

A. Cut slopes shall be constructed to no steeper than 2:1 (horizontal:vertical). Fill slopes shall be constructed to no steeper than 2:1 (horizontal:vertical). Prior to placement of fill on an existing slope the existing slope shall be benched. The benches shall be in a ratio of 4 horizontal to 1 vertical. The face of the fill slopes shall be compacted as the fill is placed, or the slope may be overbuilt and then cut back to the design grade. Compaction by track walking will not be allowed.

3.14 FINISH GRADING

A. At completion of project, site shall be finished graded, as indicated on Drawings. Finish grades shall be “flat graded” to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be +-0.05’. Tie in new and existing finish grades. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas the finish grade on which it is placed shall be lowered to allow for sod thickness.

B. All landscape areas shall be left free of rock or foreign material.

C. All landscape areas shall be approved by Architect prior to any planting.

3.15 SURPLUS MATERIAL

A. Excavated material not required for grading or backfill shall be removed from site at contractor’s expense.

3.16 CLEANING

A. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

END OF SECTION 31 00 00

SECTION 31 23 33 – TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The general conditions, supplementary conditions and Division 1 are fully applicable to this section as if repeated herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 00, Earthwork.

B. Section 33 40 00, Site Drainage.

C. Section 33 00 00, Site Utilities.

D. Section 32 12 00, Asphalt Concrete Paving

1.3 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. Contractor / Installer shall have been in business for five (5) years providing/finishing similar size projects and complexity.

1.4 SUBMITTALS

A. Submit Manufacturers data and shop drawings.

1.5 WARRANTY

A. Submit fully executed warranty for work and materials in this section.

1.6 REFERENCES AND STANDARDS

A. California Building Code current edition.

B. California Plumbing Code current edition.

1.7 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.8 PROJECT CONDITIONS

A. Contractor shall acquaint himself with all existing 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. Field verify that all components, backing, etc. by others are installed correctly to proceed with installation of products as herein specified.

C. Trench dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for trench dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.9 PROTECTION

A. Adequate protection measures shall be provided to protect workers 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. Repair all trenches in grass areas with new sod (seeding not permitted) and "stake-off" for protection.

B. Contractor shall be solely and completely responsible for working conditions at the job site, 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. Any construction review of the Contractor's performance conducted by the Architect or Owner is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.

D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. Keep all excavations free from water during entire progress of work, regardless of cause, source or nature of water.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

H. Trees: Carefully protect existing trees which are to remain.

1.10 TRENCH SAFETY PROVISIONS

A. General Contractor shall be solely responsible for safety design, construction and coordination with agencies having jurisdiction. If such plan varies from shoring system standards established by Construction Safety Orders, plan shall be prepared by registered civil or structural engineer.

B. Nothing herein shall be deemed to allow use of shoring, sloping or protective system less effective than that required by Construction Safety Orders of California State Division of Industrial Safety.

C. When trenching through paved surface, provide steel trench plates to cover open trenches daily until trenches are backfilled.

1.11 SEASONAL LIMITS

A. No backfill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, full operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

B. Material above optimum moisture shall be processed per section 31 00 00, 3.08, B.

1.12 TESTING

A. General: Refer to Quality Requirements.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Backfill materials: Pipeline and conduit trench backfill as shown on the plans and as specified below.
   1. ¾ inch crush rock.
   2. Native Materials: Soil native to Project Site, free of wood, organics, and other deleterious substances. Rocks shall not be greater than 3-inches.
   3. Sand: Fine granular material, free of organic matter, mica, loam or clay.
   4. Lean Mix Concrete/Controlled Density Backfill: 2 sacks cement slurry.
   5. Class 2 aggregate base, ¾” rock, per Caltrans section 26-1.02B

B. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

C. Provide other bedding and backfill materials as described and specified in Section 31 00 00, Section 33 40 00 and Divisions 15 and 16.

PART 3 – EXECUTION

3.1 INSPECTION

A. Verification of Conditions:
   1. Examine areas and conditions under which work is to be performed.
   2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.

3.2 COORDINATION

A. General Contractor shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.3 INSTALLATION

A. Perform work in accordance with pipe manufacturer's recommendations, as herein specified and in accordance with drawings.

3.4 TRENCHING

A. Make all trenches open vertical construction with sufficient width to provide free working space at both sides of trench around installed item as required for caulking, joining, backfilling and compacting; not less than 12 inches wider than pipe or conduit diameter, unless otherwise noted.

B. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.

C. Trench straight and true to line and grade with bottom smooth and free of edges or rock points.

D. Where depths are not shown on the plans, trench to sufficient depth to give minimum fill above top of installed item measured from finish grade above the utility as follows:
   1. Sewer pipe: depth to vary
   2. Storm drain pipe: depth to vary
   3. Water pipe - Fire Supply: 36 inches
   4. Water pipe – Domestic Supply: 30 inches

E. Where trench through existing pavement saw cut existing pavement in straight lines. Grind existing asphalt on each side of trench 3" wide x ½ the depth of the section. Apply tack coat to vertical surfaces before installing new asphalt. Replace asphalt and concrete pavement sections

to matched existing conditions. All new asphalt patch shall receive two coats seal coat. In concrete pavement provide expansion and control joints to match existing joint layout.

3.5 BACKFILL

A. Pipe Trench Backfill is divided into two zones:
   1. Bedding: Layer of material directly under the pipe upon which the pipe is laid.
   2. Initial Backfill: Backfill from the top of the bedding to 12 inches (compacted) over the top of the pipe.

B. Bedding and Initial Backfill:
   1. Type of material for Bedding and Pipe Zone shall be as required by Drawings.
   2. Compaction of Bedding and Initial Backfill shall be achieved by vibratory plate as necessary to consolidate material.
   3. Backfill shall be brought up at substantially the same rate on both sides of the pipe and care shall be taken so that the pipe is not floated or displaced. Material shall not be dropped directly on pipe.

C. Backfill Compaction:
   1. Backfill shall be placed in layers which, when compacted shall not exceed 8 inches in loose thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity. Do not backfill over, wet, frozen or soft subgrade surfaces. Employ a placement method that does not disturb or damage foundation walls, perimeter drainage, foundation damp-proofing, waterproofing or protective cover.
   2. When moisture content of fill material is below that required to achieve specified density, add water until proper moisture content is achieved. When moisture content is above that required, aerate by blading or other methods until specified moisture content is met, see section 310000, 3.08, B.
   3. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to 90% of maximum dry density while at specified moisture content. Compact each layer over its entire area until desired density has been obtained.
   4. The top 6 inches of subgrade compaction under pavement or building shall be per Earthwork section 31 00 00.
   5. Compaction: All backfill operations shall be observed by the Inspector of Record and/or Geotechnical Engineer. Field density tests shall be made to check compaction of fill material. If densities are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified densities. Notify Inspector and Architect at least 24 hours in advance of any operation.

TRENCH AND SITE RESTORATION

A. Finished surface of trenches shall be restored to a condition equal to, or better than the condition as existed prior to excavation work.

3.6 PROTECTION

A. Protect existing surfaces, structures, and utilities from damage. Protect work by others from damage. In the event of damage, immediately repair or replace to satisfaction of Owner.

B. Repair existing landscaped areas to as new condition. Replant trees, shrubs or groundcover with existing materials if not damaged or with new materials if required. Replace damaged lawn areas with sod, no seeding will be permitted.

C. Replace damaged pavement with new compatible matching materials. Concrete walks to be removed to nearest expansion joint and entire panel replaced. Asphalt to be cute neatly and replaced with new materials.

D. Any existing materials removed or damaged due to trenching to be returned to new condition.

3.7 SURPLUS MATERIAL

A. Remove excess excavated material, unused materials, damaged or unsuitable materials from site.

3.8 CLEANING

A. Contractor will keep the work areas in a clean and safe condition so his rubbish, waste, and debris do not interfere with the work of others throughout the project and at the completion of work.

B. After completion of work in this section, remove all equipment, materials, and debris. Leave entire area in a neat, clean, acceptable condition.

END OF SECTION 31 23 33

SECTION 320120 - DETECTABLE WARNING SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Raised truncated domes.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Detectable warning surfaces:
      a. Detectable warnings surfaces shall comply with 2022 CBC Section 11B-705.1.
      b. Detectable warning surfaces shall be yellow conforming to FS 33538 of Federal Standard 595C, except for locations at curb ramps, islands, or cut-through medians where color used shall contrast visually with that of adjacent walking surfaces, either light-on-dark, or dark-on-light. CBC Sections 11B-705.1.1.3.
      c. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. CBC Section 11B-705.1.1.4.
      d. Provide minimum 5 year warranty per DSA Bulletin 10/31/02, revised 04/09/08.

1.3 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Samples: 5 by 5 inch sample.

C. Shop Drawings: Show fabrication details, composite structural system, joints, and material to be used as well as outlining installation materials and procedure.

D. Qualification Data: For manufacturer.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance requirements indicated, based on comprehensive testing of current materials.

F. Minutes of preinstallation conference.

1.4 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Duration: 5 years. Such warranty shall indicate compliance with architectural standards as published in the current edition of the California Building Standards Code, and also include durability criteria which indicate that the shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for specified years after initial installation.
   1. As used in this bulletin, "not degrade significantly" means that the product maintains at least 90 percent of its approved design characteristics, as determined by the enforcing agency.

B. Installer’s Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Raised Truncated Domes: Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.
   1. Armorcast Products Company. (Basis of Design)
   2. Access Tile.
   3. Armor-Tile by Engineered Plastics Inc.
   4. ADA Tactile Systems.
   5. Or equal.

2.2 RAISED TRUNCATED DOMES

A. Surface applied system:
   1. Product: Model A6003648 by Armorcast Products Company.
   2. Compressive Strength: 11,430 PSI per ASTM C-170-99.
   3. Shear Strength: 11,670 PSI per ASTM D-372-02.
   4. Flexural Strength: 3,330 PSI per ASTM C-580-02.
   5. Modulus Elasticity: 1,776,400 PSI per ASTM C-580-02.
   6. Tensile Strength: 1,710 PSI per ASTM C-307-99.
   7. Chemical Resistance: Pass per ASTM D-543.
   8. Simulated Sunlight: Pass per ASTM D-1501.
   9. Accelerated Service Test: Pass per ASTM D-756.
   10. Water Absorption: <.1% per ASTM D-570.
   11. Flammability Test: Pass per ASTM D-635.
   12. Fungus Resistance Test: No Growth per ASTM G-21.
   13. Smoke Density: 0.3 (DS@1.5 Minutes) and 14 (DS@4 Minutes) per ASTM E-662-03.
   14. Color: Yellow.
   15. Installation: Flush install by pressing into wet concrete per manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proceed with operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 INSTALLATION

A. Surface Applied System:
1. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
2. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.
3. Ensure that the surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to the Architect.
4. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. A thin permanent marker works well. Remove tile when done marking its location.
5. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with a diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.
6. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for a minimum of 30 days.
7. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.
8. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2” width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.
9. Set the tile true and square to the curb ramp area as detailed in the design drawings.
10. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3-1/2 inch using the recommended diameter bit. Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.
11. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or blow away dust and set the mechanical fastener as described below, before moving on to the next hole.

12. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.
13. Working in a sequence which will prevent buckles in the tile, proceed to drill and install all fasteners in the tile's molded recesses.
14. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer's recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent concrete back 1/2” from the tile's perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.
15. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.

END OF SECTION 320120

SECTION 32 12 00 – ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 00, Earthwork.

B. Section 31 23 33, Trenching and Backfilling.

C. Section 33 40 00, Site Drainage.

1.3 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.

D. Contractor shall provide verification that asphalt mix temperature meets the requirements of this specification at time of application.

E. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.

F. Sieve analysis from testing laboratories identifying rock/sand percentages within the asphalt mix shall have a testing date within 90 days of contract signing.

G. Sieve analysis from a testing laboratory identifying rock/sand percentages within the class 2 aggregate base rock shall have a testing date within 90 days of contract signing.

1.4 SUBMITTALS

A. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.5 WARRANTY

A. Refer to General Conditions.

1.6 REFERENCES AND STANDARDS

A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.

C. ANSI/ASTM D1557-02 - 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.

D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).

E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

F. CALTRANS Standard Specifications.

G. CAL-OSHA, Title 8, Section 1590 (e).

H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.7 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Base Course: Do not lay base course on muddy subgrade, during wet weather, or when atmospheric temperature is below 40 degrees F.
   2. Asphalt Surfacing: Do not apply asphaltic surfacing on wet base, during wet weather, or when atmospheric temperature is below 50 degrees F.

1.9 EXISTING SITE 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.

1.10 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, the Contractor shall be solely and completely responsible for working conditions at the job site, 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. Any construction review of the Contractor's performance conducted by the owner's representative is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

D. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The 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.

E. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

F. 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.

1.11 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.12 TESTING

A. General: Refer to Quality Requirements.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer

will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and backcharged to Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sterilant: Soil sterilizer shall be Esplanade 200 SC or approve equal and approved for use in California.
   1. Soil sterilizer shall be applied in strict accordance with manufacturer's instructions.

B. Base Course Aggregate: State Specifications, Section 26, Class 2 aggregate base (3/4" max.).

C. Asphalt Binder: Steam-refined paving asphalt conforming to State Specifications, Section 92, viscosity grade PG 64-10. Asphalt binder additives for HMA per Caltrans approved list of manufacturer's.

D. Liquid Asphalt Tack Coat: Per CALTRANS section 94.

E. Surface Course Aggregate: Mineral aggregates for Class "A" asphalt concrete, conforming to State Specifications 39-2.02, ½" maximum, medium gradient. 3/8" maximum gradient at Playcourt.

F. Seal Coat: shall be a pre-mixed asphalt emulsion blended with select fillers and fibers such as, or equal to:
   1. "Park-Top No. 302", Western Colloid Products.
   2. "OverKote", Reed and Gram.
   3. "Drivewalk", Conoco Oil.

G. Wood Headers and Stakes: Pressure treated.

H. Pavement Marking: Colors as directed by Architect. Colors of painted traffic stripes and pavement markings must comply with ASTM D 6628.
   1. Waterborne traffic line - colors white, yellow and black, State specification PTWB-01R2.
   2. Waterborne traffic line for the international symbol of accessibility and other curb markings – blue, red and green, Federal specification TT-P-1952F.

I. Precast Concrete Bumpers: 3000 psi at 28 day minimum strength; 48" length unless otherwise indicated; provide with steel dowel anchors and concrete epoxy.

J. Pavement Epoxy; K-Lite; Ktepx-590; Ennis Epoxy HPS2 or an approved equal.

K. Crack Filler;
   1. Cracks up to ½": QPR model CAR08, 10oz asphalt crack filler; Star STA-FLEX Trowel Grade crack filler or approved equal.
   2. Cracks ¼" – 1": "Docal 1100 Viscolastic, distributed by Conoco, Inc., Elk Grove, CA, (916) 685-9253, or approved equal.
   3. Cracks greater than 1": Hot Mix, Topeka.

L. Reclaimed Asphalt Paugment (RAP). HMA Class A may be produced using RAP providing it does not exceed 15% of the aggregate blend.

2.2 MIXES

A. General: Plant mixed conforming to State Specifications, Section 39, Class A, ½" maximum, medium grading. 3/8" maximum grading shall be used at hardcourt.

B. Temperature of Hot Mix Asphalt: Not less than 275 degrees F nor more than 325 degrees F when added to aggregate.

C. Temperature of Hot Mix Aggregate: Not less than 250 degrees F nor more than 325 degrees F when asphalt is added.

D. Temperature of Hot Mix Asphalt Concrete: Asphalt shall be not less than 285 degrees at time of application, nor more than 350 degrees. Asphalt not meeting the required temperature shall not be used.

PART 3 - EXECUTION

3.1 EXAMINATION OF CONDITIONS

A. Conditions of Work in Place: Subsurfaces which are to receive materials specified under this Section shall be carefully examined before beginning work hereunder, and any defects therein shall be reported, in writing, to the Architect. Work shall not be started until such defects have been corrected. Starting of work shall imply acceptance of conditions as they exist.

3.2 PREPARATION

A. Sub-Grade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of aggregate base. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

B. Cleaning: Existing surfaces and new surface shall be clean of all dirt, sand, oil or grease. All cracks shall be cleaned and free of all debris and vegetation. Hose down entire area with a strong jet of water to remove all debris.

3.3 INSTALLATION

A. Headers:
   1. General: Install as edging to asphalt paving, except where adjoining existing pavement, concrete curbs, walks or building.
   2. Existing Headers: Remove existing headers where new paving will join existing. Saw cut existing asphalt to provide clean edge.

3. Lines and Levels: Install true to line and grade. Cut off tops of stakes 2-inches below top of header so they will not be visible on completion of job.

B. Asphalt Paving:
1. Base Course: Install in accord with State Specifications, Section 26. Compact to relative compaction of not less than 95%, ASTM D1557. The material shall be deposited on the subgrade in such a manner as to provide a uniform section of material within five percent tolerance of the predetermined required depth. Deposition will be by spreader box or bottom dump truck to prevent segregation of the material. The material so deposited on the subgrade shall have sufficient moisture which, in the opinion of the project inspector is adequate to prevent excessive segregation. It shall then be immediately spread to its planned grade and cross section. Undue segregation of material, excessive drifting or spotting of material will not be permitted. If in the opinion of the site geotechnical engineer, the material is unsuitably segregated, it shall be removed or completely reworked to provide the desired uniformity of the material.
   a. Moisture content and compaction of base material shall be tested immediately prior to placement of asphalt paving.
2. Sterilant: Apply specified material at manufacturer's recommended rate. Applicator of sterilant material shall be responsible for determining location of all planter areas. Apply specified material over entire base course area just prior to application of asphalt. Follow manufacturer's printed directions.
3. Liquid Asphalt Tack Coat: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed.
4. Asphalt Concrete Surface Course:
   a. Comply with State Specifications, 39-6 except as modified below.
      1) Final gradation shall be smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 91% of the theoretical maximum specific gravity determined by California Test Method #309. Maximum variation 1/8 inch in 10' when measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. In no case shall accessible parking spaces or loading and unloading areas exceed 2% slope in any direction.
      2) Asphalt material shall be delivered to the project site in a covered condition to maintain acceptable temperature. Onsite inspector shall verify temperature of asphalt upon truck arrival to the site.
5. Placement and adjustment of Frames, Covers, Boxes and Grates: The Contractor shall set and adjust to finish grade all proposed and existing frames, covers, boxes, and grates of all manholes, drop inlets, drain boxes, valves, cleanouts, electrical boxes and other appurtenant structures prior to placement of asphaltic concrete.
6. Water Testing: All paved areas shall be water tested, to check drainage, in the presence of the project inspector prior to placement of seal coat. The surface of asphalt paving shall not vary more than 1/8 inch above or below the grade established on the plans. If variations in grade are present, they will be corrected by overlaying paving and/or pavement removal and replacement as directed by the Architect.
7. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. In trenches; grind existing asphalt on each side of trench 6” wide x ½ the depth of the section. Apply tack coat to vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Sawcut, remove and patch existing paving where cutting is necessary for installation of piping or conduits under Divisions 2, 15 and 16.

Apply two coats seal coat to all trench patches.

C. Seal Coat:
1. Apply seal coat to all new asphalt paving surfaces, paved areas or trench patch. Seal coat shall be applied no sooner than 30 days from time of asphalt placement, no exceptions.
2. Surface Preparation: surface and cracks shall be clean of all dirt, sand, oil or grease. All cracks shall be filled to a level condition after curing. Make multiple fill applications until a level condition is achieved. Failure to do so will be the reason for rejection. Hose down entire area with a strong jet of water to remove all debris. Remove soft, loose, or otherwise damaged areas of asphalt concrete to full depth of damage and replace with compacted hot mix asphalt concrete as specified herein. Minor holes and imperfections may be patched using hot mix asphalt or mastic using sand/SS-1-H. Use wire brush for removal of oil and grease; prime with shellac or synthetic resin as recommended by manufacturer of pavement sealer material.
3. Seal Coat Seal Application: Thoroughly mix materials and apply in the presence of the onsite inspector. Failure to do so will be cause for rejection. Apply in accordance with manufacturer's written instructions.
    a. The minimum application rate for each applied coat shall be 30gals per 1000 sq. ft. Two coats of sealcoat will be required.
    b. Clean-Up and Precautions: As recommended by pavement sealer material manufacturer.

D. Asphalt Concrete Overlay Paving:
1. Comply with State Specifications, 39-6 except as modified below.
2. Grind or remove existing asphalt concrete paving at limits of overlay paving to provide a minimum 1-1/2" overlay thickness. Limits of grinding or removal shall be field verified to insure that finished paving surface will have a one percent minimum slope.
3. Thoroughly clean surface to remove vegetation, dirt, sand, gravel and water from surface and from cracks. Vegetation shall be treated 7 days prior to removal with an herbicide.
4. Cracks greater than 1 inch shall be filled with hot mix asphalt and rolled and compacted. Cracks less than one inch shall be filled with crack filler. Potholes shall be filled with hot-mix rolled and compacted. Contractor shall have Engineer approve crack and pothole repair prior to overlay. Provide leveling courses of hot mix asphalt as required to achieve finish grades shown on the drawings.
    a. Cracks less than one inch in width shall be level after curing. Contractor shall make multiple filling applications as necessary to achieve a level condition.
5. Place overlay when ambient air temperature is 40 degrees F. and rising, and when pavement is dry.
6. An asphalt tack coat shall be applied to existing surface area at a rate of 0.20 gallons per square yard. Application width shall be width of fabric plus 2 to 6 inches.
7. Place, spread and compact asphalt overlay to provide a minimum density of 95% of maximum theoretical unit weight as determined by California Test Method #304. Maximum variation 1/8" in 10' when measured with steel straight edge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. Minimum compacted overlay thickness 1 1/2 inches.

E. Pavement Marking: pavement markings shall be done only after the seal coat has thoroughly dried. Existing surfaces to be striped with traffic paint shall be cleaned of dust, dirt, grime, oil, rust or other contaminants which will impair the quality of work or interfere with proper bond of paint coats. Surfaces shall be thoroughly cleaned by whatever means necessary that will satisfactorily

accomplish the purpose without damage to asphalt concrete. Provide measured layouts, temporary markings, templates, and other means necessary to provide required marking. Prepare and apply paint in accordance with manufacturer's instructions; paint shall be applied by spray and shall achieve complete coverage free from voids and thin spots. Where indicated on the Drawings, paint parking stall strips, lettering, arrows, accessible symbols, playfield markings, etc. on asphalt concrete paving. Paint strips shall be 4 inches wide (except otherwise indicated) and applied with two (2) coats of herein specified Traffic Line Paint; white (except as otherwise specified or indicated).

1. Paints shall be delivered to the site in unopened containers.
   a. Paint shall not be diluted, or watered down.
   b. Paint shall be applied in 10-12 wet mil thickness (4-6 mil dried). Each coat thickness shall be verified by the project inspector.
2. International Accessible Symbol: Symbol shall be white figures on a blue background. Blue shall be equal to PMS 293C. Lines and symbols shall be accurately formed and true to line and form; lines shall be straight and uniform in width. Painted edges shall be clean cut and free from raggedness, and corners shall be cut sharp and square. Tolerances: Apply striping within a tolerance 1/2 inch in 50 feet. Apply markings and striping to widths indicated with a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.

F. Colors: As directed by Architect

G. Precast Concrete Bumpers: Install in location where shown, using steel rebar dowels, and epoxy.

3.4 DEFECTIVE ASPHALT;
Defective asphalt is as described below.

A. Exposed rock pockets on the finished surface that lack the # 8- #200 fines that is required per the sieve analysis.

B. Asphalt not placed to the design grades.

C. Asphalt that ponds water.

D. Asphalt that was compacted below the minimum required temperature and is cracked.

E. Asphalt that fails to meet the minimum compaction requirements.

F. Asphalt that lacks the minimum thickness required per plan.

G. New asphalt contaminated by a petroleum product, or spilled paint.

H. Asphalt that has depressions, cracks, scored divits from dumpster wheels, heavy equipment use, heavy construction products,

I. Asphalt placed on pumping, unstable sub-grades.

3.5 CLEANING

A. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

B. Clean excess material from surface of all concrete walks and utility structures.

END OF SECTION 32 12 00

SECTION 32 16 00 – SITE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The Section describes the requirements for providing portland cement concrete paving, including accessibility ramps, sidewalks, accessible routes of travel, vehicular travel, drain structures, sewer structures, thrust blocks and for other non-structural applications.

1.2 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 00 00, Earthwork.

1.4 QUALITY ASSURANCE

A. Use only new materials and products.

B. Use materials and products of one manufacturer whenever possible.

C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted

1.5 SUBMITTALS

A. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

B. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.

C. With concrete submittal, provide documented history of mix design performance.

1.6 WARRANTY

A. Refer to General Conditions.

1.7 REFERENCES AND STANDARDS

A. California Building Code, 2022 edition.

B. ACI Standards, ACI 301-20.

C. ASTM C-94, Specification for Ready-Mixed Concrete.

D. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).

E. ASTM – American Society for Testing and Materials.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.

B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.

C. Transport, store and handle in strict accord with the manufacturer's written recommendations.

D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.

F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.9 TESTING

A. General: Refer to Quality Requirements.

1.10 ADEQUACY AND INSPECTION

A. Design, erect, support, brace and maintain formwork and shoring to safely support all vertical and lateral loads that might be applied until such loads can be carried by concrete.

B. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.

1.11 PROTECTION

A. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.

1.12 FIELD MEASUREMENTS

A. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: Portland cement, ASTM C150, Type II, per ACI 301-20.

B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.

C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 301-20.

D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.

E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Such admixture must receive prior approval and shall be included in original design mix.

F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal.

G. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.

H. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface coating, as approved by the Architect.

I. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.

J. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3’-0” O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3” concrete blocks with embedded wire ties. Concrete

supports without wire ties will not be allowed.

H. Truncated Domes: Vitrified Polymer Composite (VPC), Cast-In-Place Detectable/Tactile Warning Surface Tiles; "Armor-Tile", "Access Tile Tactile Systems", or approved equal. Tiles shall comply with Americans with Disabilities Act and the California Code of Regulations (CCR) Title 24, Part 2, Chapter 11B (dome spacing shall be 2.35"). Install tiles as recommended by manufacturer. Detectable warning surface shall be yellow and approximate 33538 of SAE AMS-STD-595A.

K. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal.

L. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.

M. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.

N. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed,non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.

O. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.

P. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.

Q. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893.
1. Reference Standard: ASTM C920, Grade P, Class 25, Use T.
2. Dow Corning 890-SL (self-leveling) Silicone, or accepted equal.
3. Dow Corning 888-NS (non-sagging) Silicone, at slopes exceeding 5%. May not be used at asphalt surfaces.
4. Color: Custom color as selected by Architect.

R. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8" "Snap Cap", Tex-Trude expansion joint cap, or an approved equal.

S. Adhesive Anchoring (Epoxy): Simpson SET-XP, or approved equal.

2.2 CONCRETE DESIGN AND CLASS

A. Class "B": Concrete shall have 1" max. size aggregate, shall have 3500 psi min. at 28 day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.

B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".

C. Mix Design: All concrete used in this work will be designed for strength in accordance with

provisions of ACI 301-20. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.

D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.3 MIX2ING OF CONCRETE

A. Conform to requirements of CBC, Chapter 19A.

B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.

C. Concrete shall be Ready-mixed Concrete.
1. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
2. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will allow for additional water.

2.4 MATERIALS TESTING

A. Testing of concrete shall be performed per article 3.12 of this specification.

2.5 EQUIPMENT

A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 - EXECUTION

3.1 APPROVAL OF FORMS AND REINFORCEMENTS

A. Forms and reinforcements are subject to approval by the Project Inspector, and notice of readiness to place first pour shall be given 48 hours prior to placement of concrete. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.

B. All reinforcing steel shall be adequately supported by approved devices on centers close enough to prevent any sagging.

C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.

D. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames

and covers that are located within the concrete placements.

1. The bars shall be placed so that there will be a minimum of 1 ½" clearance and a maximum of 3" clearance. The reinforcing steel shall be placed mid-depth of concrete slab.

E. At all right angles or intersections of concrete walks, additional 2'x2' #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2" from concrete forms and supports at mid-depth of slab.

3.2 PROTECTION

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.3 CLEANING

A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or any other coatings that would impair bond to concrete.

B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.4 FORMING

A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.

B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301-20. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.

C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.

D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.

E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.

F. Slope tie-wires downward to outside of wall.

G. Brace, anchor and support all cast-in items to prevent displacement or distortion.

H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.

I. Concrete paving, Curbs, Curb and Gutters, Ramps:
   1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20’ for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed ¼ inch depth measured from finish surface to top of felt or sealant, and ½ inch width.
   2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60’ on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
   3. Isolation Joints: 3/8” felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
   4. Exterior Concrete Paving: Install expansion joints at 20’ on center maximum, both directions, unless shown otherwise on plans.
   5. Ramps; whether shown or not all ramps shall have control joints and expansion joints.
      a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
      b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

3.5 FORM COATING

A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.

B. Before re-using form material, inspect, clean thoroughly and recoat.

C. Seal all cut edges.

3.6 INSTALLATION

A. General: Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907A.7 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as

approved by Architect.

B. Placing Tolerances:
1. Per ACI 301-20 recommended practice for placing reinforcing bars, unless otherwise shown.

C. Splices:
1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
   a. Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56" minimum for No. 6 bars. No. 4 bar shall have a minimum of 24" splice.
   b. All splices shall be staggered at 5 feet minimum.

3.7 INSPECTION

A. Slope of concrete forms and finish condition shall be checked with a two foot (2') digital level.

3.8 PLACING OF CONCRETE

A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to the owner.

B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.

C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area.

D. Remove form spreaders as placing of concrete progresses.

E. Place footings as monolithic and in one continuous pour.

F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.

G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.

H. Concrete Flatwork:
1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be true and flat with a maximum tolerance of 1/8" in 10' for flatness. Flatwork which is not flat and are outside of the maximum specified tolerances shall be made level by the Contractor at no

additional expense to the Owner.

2. Thoroughly water and soak the flatwork subgrade as required to achieve required moisture content prior to the concrete pour. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
3. Concrete vibrator shall be used to assist concrete placement.

I. Placing in hot weather: Comply with ACI 305R-10. Concrete shall not exceed 95 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.

J. Placing in cold weather: Comply with ACI 306R-16. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.

3.9 CONCRETE FINISHES

A. Concrete Finishing: Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:
1. Flatwork and Curbs medium broom finish: Typical finish to be used at all exterior walks and stairs.
2. Ramps, heavy broom finish: Concrete surfaces with slope greater than 5% including all ramps. Brooming direction shall run perpendicular to slope to form non-slip surface
3. Under no circumstances can water be added to the top surface of freshly placed concrete.

B. Seat Walls: Steel trowel.

C. Joints and Edges: Mark-off exposed joints, where indicated, with ¼” radius x 1” deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces.
1. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.

D. Exposed Concrete Surface Finishing (not including top surface of flatwork): Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "Patching" below. Removal of tie wires shall extend to distance of 2" below established grade lines. Ends of tie wires shall be cut off flush at all other, unexposed locations. Care shall be taken to match adjacent finishes of exposed concrete surface. After patching, all concrete that is to remain exposed.

3.10 CURING

A. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter: Cure utilizing Curing Compound.

If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer's recommendations.

1. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor's expense with no compensation from the owner.

B. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

3.11 DEFECTIVE CONCRETE

A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.

B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.

C. As directed by Architect or Engineer, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.

D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect or Engineer, satisfactorily restore quality and appearance of surface.

E. Defective concrete is:

1. Concrete that does not match the approved mix design for the given installation type.
2. Concrete not meeting specified 28-day strength.
3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
4. Concrete which is incorrectly formed, out of alignment or not plumb or level.
5. Concrete containing embedded wood or debris.
6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
7. Concrete not containing required embedded items.
8. Excessive Shrinkage, Traverse cracking, Crazing, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90 minutes from the time it was batched.
10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be removed.
13. Control joints (weakened planed joints) that do not meet the required minimum depth shown

on the drawings.

F. Patching: Install specified Patching Mortar per manufacturer's recommendations.

3.12 CONCRETE TESTING

A. Comply with CBC Section 1903A, 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.

B. Four identical cylinder samples for strength tests of each class of concrete and from each supplier shall be taken for not less than each 150 cubic yards of concrete, or not less than once for each 5,000 square feet of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete shall be taken whenever the mix or aggregate is changed.

C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.

D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.

F. Slump testing shall be performed at the discretion of the site inspector.

3.13 REMOVAL OF FORMS

A. Remove without damage to concrete surfaces.

B. Sequence and timing of form removal shall insure complete safety of concrete structure.

C. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 CLEANING

A. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

B. Clean excess material from surface of all concrete walks and utility structures.

C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 32 16 00

SECTION 321916 - PLAYGROUND COMPOSITE UNDERLAYMENT

PART I - GENERAL

1.1 Scope Of Work

A. Furnish all labor, material, equipment and services necessary for the installation and properties of a playground synthetic base underlayment material as part of a synthetic turf safety surface system. Defined are the primary underlayment requirements for ensuring quality, durability, environmental compatibility, performance and high-capacity subsurface drainage of the installed system.

B. Specifications listed are defined per applicable ASTM standard test methods or other national or international testing standards. All other specifications and tolerances listed shall be defined under standard ANSI and/or ISO drawing and specification rules.

1.2 References

A. Public Playground Safety Handbook, U.S. Consumer Product Safety Commission (CPSC), latest edition.

B. American Society for Testing and Materials (ASTM), International Standards Organization (ISO), European Committee for Standardization (EN), German Institute for Standardization (DIN), Cradle to Cradle Products Innovation Institute (C2CPII), Environmental Protection Agency (EPA) :

ASTM F1292-22	Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment
ASTM F3313	Standard Test Method for Determining Impact Attenuation of Playground Surfaces Within the Use Zone of Playground Equipment as Tested in the Field
ASTM D3575-20, Suffix T	Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers (Suffix T: Tensile Strength and Elongation)
ASTM D3575-20, Suffix D	Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers (Suffix D: Compressive Strength)
EN 12616	Surfaces for sports areas – Determination of water infiltration rate
DIN 53428	Testing of cellular materials - Determination of the resistance to liquids, vapours, gases and solid materials
TSM5725G (modified)	Toyota Method for determination of Coefficient of Linear Thermal Expansion (modified, -30 to 30 °C)
FMVSS 302	Test Procedure for Evaluating Flammability of Interior Materials
ASTM F925	JSP Method based on ASTM F925 (Test Method for Resistance to

(modified)	Chemicals of Resilient Flooring)
EN 14030:2010	Resistance to Acid and Alkaline Liquids
ISO 13438:2004	Resistance to Oxidation (Accelerating Aging)
ASTM G22	Determining the Resistance of Plastics to Bacteria
ASTM G21	Determining Resistance of Synthetic Materials to Fungi
ISO 14001:2015	Environmental Management Systems
ISO 9001:2015	Quality Management Systems
C2CPII	Cradle to Cradle Product Innovation Institute
EPA 6010B 7470A, 7471A	Heavy Metals, Mercury
EPA 8260B	Volatile Organics Compounds (VOCs)
EPA 8270C	Semi-Volatile Organic Compounds (SVOCs)

1.3 Quality Assurance

A. Source Quality Control

1. Product must be made in ISO accredited facility in the United States of America according to the Federal Trade Commission Made in USA Standard.
2. Shock pad must be all white in color to avoid excessive thermal movement due to sunlight exposure during installation.
3. Material must be manufactured in an ISO 9000:2015 certified facility.
4. Product must be of a homogenous material composition, with a documented chain of custody of all raw materials. Variable content material will not be accepted.
5. Manufacturer must provide documentation of material content and pre-approved standard OSHA SDS sheet.
6. Material must be covered by a pre-approved and binding 10-year limited product warranty issued by a company in the United States of America. Warranty shall include the provision that manufacturer will deliver to the Owner and install new panels to replace the non-conforming panels. The installation shall include the temporary removal and repair or replacement of the artificial turf and infill over the affected area
7. Warranty must not specify monetary limits of liability. Warranty must allow owner a notice period of at least 30 days for non-compliance claims.
8. Material must be installed according to manufacturer’s instructions, without exceptions.
9. Manufacturer must provide written procedures to selected turf supplier or contractor for the installation of turf on top of underlayment.

10. Product is to be shipped as flat panels on pre-packaged pallets. Rolled products are not acceptable.

B. Source Quality Control

1. Product must be manufactured in an ISO 14001:2015 certified facility.
2. Product must be Cradle to Cradle™ Certified Bronze (or higher) by the Cradle to Cradle Products Innovation Institute (Material Health Certificate and Product Circularity Certificate, or Full-Scope Certification)
3. Product material must not contain concentrations of metals, volatile organic compounds (VOCs), or semi-volatile organic compounds (SVOCs) at concentrations greater than EPA Regional Screening Levels or Department of Toxic Substances Control Human Health Risk Assessment (HHRA) Note 3 thresholds. (EPA 6010B, EPA 7470A EPA 7471A, EPA 8260B, EPA 8270C).
4. Product material must not contain leachable concentrations of metals, VOCs, or SVOCs (using the synthetic precipitation leaching procedure) greater than maximum contaminant levels (MCLs) or Regional Water Quality Control Board Environmental Screening Levels for groundwater and surface water - fresh water aquatic habitat. (EPA 60108, EPA 7470A EPA 7471A, EPA 8260B, EPA 8270C).
5. Product must not contain a chemical on the current California Proposition 65 Safe Drinking Water and Toxic Enforcement Act of 1986 - Update effective 06 JUNE 2014
6. Product must not contain concentrations of substances at hazardous waste levels per California Code of Regulations, Title 22, Division 4.5, Chapter 11 – Identification and Listing of Hazardous Waste.

C. Submittals

1. General: Bidding contractor must identify performance base system with bid package. If a non-specified product is identified, the proposed alternate product must be submitted and pre-approved by the design architect/engineer 10 days prior to the bid opening. If bidding contractor does not identify a manufacturer, the Township/School District will assume that the specified product is included in the bid package and will not consider substitutions.
2. Product Data: Submit 8.5” x 11” product sample and typical properties sheet.
3. Shop Drawings: Submit cross-sectional view showing product installation in relation to sub-base and synthetic turf (including edge attachment).
4. Test Data: Submit all applicable test data for compliance to specifications. All testing to be performed following applicable ASTM or other internationally recognized standards and procedures.
5. Installation: Submit copy of product installation instructions. Submit copy of installation recommendations.
6. Warranty: Submit copy of product 10-Year warranty coverage as specified in 4.6 – 4.7.

1.4 Installer Qualifications

A. All materials under this section shall be installed by the Manufacturer or its Certified Installers. The playground surfacing installation shall not be performed by anyone other than the product Manufacturer or its Certified Installers.

PART II - PRODUCTS

2.1 General

A. An impact energy absorbing sub-base drainage system designed specifically for use with synthetic turf is required. The specified material must have physical, drainage and performance properties that meet the following requirements:

2.2 Materials

A. General

1. Minimum material nominal thickness 50.8 mm (2") – material thickness must be within ± 2 mm (± 0.08")
2. Tensile Strength >50 psi (ASTM D3575-20, Suffix T)
3. Tensile Elongation >10% (ASTM D3575-20, Suffix T)
4. Compression Strength >15 psi @ 25% strain (ASTM D3575-20, Suffix D)
5. Water Permeability >1500 in/hr (EN 12616)
6. Linear Thermal Expansion < 0.10 mm /m /°C (TSM5725G – modified, -30 C to 30 C)
7. Material Flammability Flame Spread < 100 mm /min. (FMVSS 302)
8. Material Water Absorption ≤ 2% (vol.) after 24 hr (DIN 53428)
9. Material Resistance to Chemicals ≤ 2 (JSP Method based on ASTM F925)
10. Material Resistance to Bacteria - no growth (ASTM G22)

B. Underlayment Pad

1. Description: Resilient Molded Expanded Polypropylene Base System
2. Product: Brock PowerBase PLAY50 (PLB50XL) or pre-approved equal
3. Contact Information:

   Brock USA LLC
   3090 Sterling Circle
   Boulder, CO 80301
   Telephone: (303) 544-5800
   sales@brockusa.com
   www.brockusa.com

   Ronnie Pascale
   National Director of Sales
   Telephone: (804) 366-1368
   rpascale@brockusa.com

4. Manufacturing/Ordering Information:

   Brock USA LLC
   3090 Sterling Circle
   Boulder, CO 80301

Telephone: (303) 544-5800
sales@brockusa.com

5. Product format: Interlocking panels
   a. Size: Approximately 73.5 x 49.0 inches (1867 x 1245 mm) overall dimensions.
   b. Area: Nominal net coverage per panel of 23.59 ft^2 (2.19 m^2).
   c. Thickness: 2.0" (50.8 mm) ± 0.08" (2 mm).
   d. Panel Weight: Approximately 5.87 lbs / panel

C. Impact Safety Requirement

1. Surface system must provide average HIC <1,000 upon initial testing of installed playground when tested at the critical fall height (CFH)/critical height (CH) determined in ASTM F1292 testing (ASTM F3313).

PART III – EXECUTION

3.1 Preparation

A. Prepare subgrade in accordance with the project geotechnical report and the manufacturers specifications.

B. Install base materials, as detailed on the plans. Base shall be approved and tested by the owner's Representative prior to installation of the underlayment material.

3.2 Underlayment

A. Install underlayment per manufacturers specifications. Obtain written installation instructions and procedures from the manufacturer.

3.3 Surplus Material

A. Provide 10% of the total underlayment to the owner. Surplus quantities to be identified in writing by the general contractor at the time of order placement.

3.3 Project Completion

A. Upon completion of installation, a walk-through will be conducted to inspect the quality of work and ensure all details meet specifications.

B. A punchlist of unacceptable or incomplete items will be documented and agreed upon for completion prior to final project closeout and acceptance.

END OF SECTION

SECTION 328400 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 Scope of Work

A. Furnish all labor, materials, and equipment necessary to complete the irrigation system work as indicated on the Drawings and specified herein.

B. Pressure testing/verification of available water pressure to ensure proper function of the irrigation system.

B. Test the entire irrigation system to ensure proper operation.

C. Adjust and repair damaged irrigation components that will remain adjacent to or directly involved in the work limits.

1.2 Quality Assurance & Requirements

A. Manufacturer's Directions: Manufacturer's directions and detailed Drawings shall be followed in all cases where the manufacturers of articles used in this Contract furnish directions covering points not shown in the Drawings and Specifications.

B. Ordinances and Regulations
1. All local, municipal, and state laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these Specifications and their provisions shall be carried out by the Contractor. Anything contained in these Specifications shall not be construed to conflict with any of the above rules and regulations or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of the Specifications and Drawings shall take precedence.
2. Conform to all applicable sections of the local code.
3. The materials and work of this section shall conform to all applicable provisions of the latest editions of the Uniform Plumbing Code, the California Electrical Code, and all codes properly governing the materials and work to be performed at the project site.
4. All electrical materials and work shall conform with California Administrative Code, Title 23, Part 3, Basic Electrical Regulations, Article 18 E 110-16.

C. Explanation of Drawings
1. All offsets, fittings, sleeves, etc., which may be required are not indicated. Carefully investigate the structural and finish conditions affecting all the work and plan the 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. Due to the scale of the Drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required to complete the irrigation system.
2. Before proceeding with any work, the Contractor shall check and verify all dimensions and quantities and shall immediately inform the Project Inspector of any discrepancy between the Drawing and/or the Specifications and actual conditions. No work shall be done in any area where there is such a discrepancy until written approval for the same has

been given by the Project Inspector. The Contractor shall assume full responsibility for work installed without approval.

3. All material shall be installed to avoid conflicts between irrigation and planting, existing or proposed utilities, and other construction features.
4. Contractor shall verify prior to and during construction that contract documents reflect the latest revisions, change orders, and plan checks. Contractor shall be able to produce such documents at the request of the Project Inspector at any time during construction. Pipe sizes indicated on the Drawings are minimum allowable.

1.3 Existing Conditions

A. Contractor shall verify locations of all existing utilities, whether shown on plans or not. The Contractor shall notify members of U.S.A. two (2) working days in advance of performing any excavation work by calling the toll-free number 1-800-642-2444.

B. Information on the Drawings relative to existing conditions is approximate only. Deviations found necessary during construction to conform to actual conditions, as approved by the Project Inspector, shall be made without additional cost.

C. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to existing utilities which are caused by his operation or neglect and shall pay all costs to repair or replace utilities damaged by his work.

D. Contractor shall schedule site meeting with Project Inspector and Owner's Representation to review existing utilities and water stubs within the limits of the project.

1.4 Submittals

A. Material List
1. Contractor shall furnish the articles, equipment, materials, or processes specified by name in the Drawings and Specifications.
2. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.
3. Equipment or materials installed or furnished without prior approval of the owner shall be rejected. The contractor shall be required to remove such materials from the site at no additional cost to the owner.
4. Approval of any item, alternate or substitute, indicates only that the product or products apparently meet the requirements of the Drawings and Specifications on the basis of the information or samples submitted. The Contractor shall assume full responsibility (in written form) for the performance of any substitutions. The owner's decision for approval or rejection of any substitution is final.

1.5 Close-out Documents

<u>The following items shall be provided prior to the start of the landscape maintenance period</u>.

A. Record Drawings
1. The Contractor shall dimension from two (2) permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:
a. Connection to existing water lines.

b. Connection to existing electrical power.
c. Routing of irrigation pressure lines (dimension maximum 100' along routing).
d. Sleeves
e. Irrigation control valves.
f. Routing for control wiring.
g. Other related equipment, as directed by the Project Inspector.

2. Record drawings shall be clear and legible in an electronic format to ensure they are easily understandable and usable for future reference.
3. Provide a sample record drawing sheet for owner review prior to submitting the final record drawing set.
4. On or before the date of the final inspection prior to the start of the maintenance period, the Contractor shall deliver the corrected and completed record drawings set to the owner. The final record drawing set shall be in an electronic PDF format. Include the name and company of the person who prepared the record drawings, the total number of sheets in the set and the date that the record drawings were prepared to the owner on the first sheet of the set.
5. The record drawings shall be drawn over the permit-approved irrigation plans. Multiple colors shall be used to clearly differentiate between the various components of the record irrigation system.
6. Delivery of the documents shall not relieve the Contractor of the responsibility of furnishing the required information that may be omitted from the prints.

B. Controller Charts
1. Record Drawings shall be approved by the owner before controller charts are prepared.
2. Provide two (2) sets of controller charts for each controller supplied. One set to be provided to the owner and one set to be included in each controller.
3. The chart shall show by using a different color, the area controlled by each remote-control valve. Chart shall be the maximum size which the controller door will allow.
4. The chart shall be a reduced drawing of the actual record drawing system. In the event the controller sequence is not legible which the drawing is reduced, it shall be enlarged to a size that is readable.
5. When completed and approved, the chart shall be hermetically sealed between two (2) pieces of plastic, each piece being a minimum ten (10) mils thick.

<u>The following items shall be provided prior to the completion of the landscape maintenance period and turn-over to the owner</u>.

A. Operation and Maintenance Manuals and Equipment to be Provided.
1. Prepare and deliver two (2) operation manuals as specified and as follows:
a. Catalog and parts sheets on every material and equipment installed under this contract. Include name, location and phone numbers of each product manufacturer and local representative.
b. Guarantee statement.
c. Complete operating and maintenance instructions on all major equipment.
2. Supply as a part of this Contract the following tools:
a. Two (2) sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project.
3. The above-mentioned equipment shall be turned over to the Owner at the conclusion of the project, before final observation can occur.

4. Provide evidence in writing to the Landscape Architect that the owner has received all material stated herein.

1.6 Product Delivery, Storage And Handling

A. Handling of PVC Pipe and Fittings: The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and if installed replaced with new.

1.7 Guarantee

A. The guarantee for the irrigation system shall be one year from the date of final acceptance of the project.

B. Form of Guarantee: Guarantee shall be submitted to the contractors' letterhead as follows:

GUARANTEE FOR IRRIGATION SYSTEM

PROJECT:

LOCATION:

We hereby guarantee the irrigation system we have furnished and installed against defects in materials and workmanship, ordinary wear and tear and unusual abuse, or neglect accepted, and that the work has been completed in accordance with the plans and specifications. We agree to repair or replace any or all of the work, together with any other adjacent work which may be displaced by so doing, that may prove to be defective in its workmanship or materials within a period of one (1) year after the date the written notice of completion for the project, at no additional cost to the owner. We shall make such repairs or replacements within 14 calendar days following written notification by the owner. When the immediate repair or replacement of the work is necessary to ensure public safety and welfare, which would be endangered by continued usage of the facility, such circumstance will be deemed an operational emergency. In the event of such an emergency, after the owner contacts our firm and after authorizing 24 hours to initiate repairs, if we fail to initiate and diligently complete such repairs in a timely manner, the owner may direct local forces to perform such functions as the owner may deem necessary to correct the work and immediately place the facility back in operational condition. If such procedure is implemented, we shall bear all expenses incurred by owner. In all cases, the judgment of the owner shall be final in determining whether an operational emergency exists. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from owner (other than an operational emergency), we authorize the owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PRINTED NAME & TITLE: _____

SIGNATURE: _____

ADDRESS: _____

PHONE: ( ) _____

PART 2 - PRODUCTS

2.1 Materials

A. General
1. Use only new materials of brands and types noted on the Drawings, specified herein or approved equals.
2. All equipment shall be installed per manufacturers' recommendations.

B. Backfill Material
1. Screened existing site material, as approved by the Project Inspector, shall be used for backfilling material. Backfill material shall be free from organic materials, large clods of earth or rocks larger than one (1) inch diameter, trash, debris, rubbish, broken cement, asphalt material or other objectionable substances.
2. Imported backfill material, if required, shall be clean soil consisting of earth, sandy clay, loam or other approved materials, with no large clods of earth or rocks larger than one-half (1/2) inch in size.
3. Sand bedding material shall be fine granular sand material containing no foreign matter larger than one-half (1/2) inch in size.

C. Drainage Fill Material
1. Drainage fill material shall be three-quarter (3/4) inch washed, hard and durable, fragments of screened or broken stone or gravel.

D. Backflow Blanket
1. Blanket to be provided with double stitched heavy-duty threads, UV protection and fire-resistant insulation as manufactured by Weatherguard, or approved equal. Size as required. Color: green.

E. Rodent Guard
1. 1" square galvanized mesh, 16 gauge minimum.

F. Irrigation Pipe Sleeving
1. PVC Schedule 40 pipe. Minimum 2 times the size of the pipe to be sleeved.

G. Control Wire Conduit
1. Gray PVC schedule 40 electrical conduit, ASTM F-512, size as required.

H. PVC Pressure Main Line Pipe and Fittings.
1. Pressure main line piping for sizes one-and one-half (1-1/2) inch and smaller shall be PVC Schedule 40 with solvent-welded joints.
a. Pipe shall be made from NSF approved Type I, Grade I, PVC compound conforming to ASTM resin specification D1785. All pipe shall meet requirements set forth in Federal Specification PS-21-70. (Solvent-weld Pipe).
2. Pressure main line piping for sizes two (2) inches and four (4) inches shall be PVC Class 315 with solvent weld joints.
a. Pipe shall be made from an NSF (National Sanitation Foundation) approved Type I, Grade I, PVC compound conforming to ASTM resin specification D1784. All pipe

shall meet requirements as set forth in Federal Specification PS-22-70, with an appropriate standard dimension ratio (S.D.R./ Solvent-weld Pipe).

3. PVC solvent-weld fittings for 2" or larger mainline, Class 315 mainline and Class 200 laterals shall be Schedule 40; all other solvent-weld fittings shall be Schedule 40, 1-2, II-I NSF approved conforming to ASTM D2466.
4. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of the type and installation methods specified by the manufacturers for each type of pipe.
6. All PVC pipe shall be marked continuously and permanently with the following information: Manufacturer's name, nominal pipe size, schedule or class of pipe, pressure rating in P.S.I. extrusion, NSF approval and date of extrusion.
   All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.S. schedule and NSF seal of approval.
7. Trace wire shall be placed on top of pressure main line. Wire to be 14/1 Single Strand AWG-UF copper (blue color).

I. PVC Non-Pressure Lateral Line Piping
   1. Non-pressure buried lateral line piping shall be PVC Class 200 with solvent-weld joints.
      a. Pipe shall be made from NSF approved, Type I, Grade II, PVC compound conforming to ASTM resin specification D1784. All pipe shall meet requirements set forth in Federal Specification PS-22-70, with an appropriate standard dimension ratio.
   2. Except as noted, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as set forth in Section 2.01E of these Specifications.
   3. All offsets shall be a minimum of three-quarter (3/4) inch unless contractor receives written approval from the owner.

J. PVC Threaded Nipples
   1. PVC Schedule 80. Size as required.

K. Control Wire Conduit
   1. Gray PVC schedule 40 electrical conduit, ASTM F-512, size as required.

L. Electric Remote Control Valve Assembly
   1. All electric remote-control valve and ball valve shall be of the same type, manufacturer and sizes as indicated on the Drawings and/or as specified herein or approved equal.
   2. All remote-control valves shall have a manual flow adjustment.

M. Control Wiring
   1. Connections between the automatic controllers and the electric control valves shall be made with direct burial copper wire AWG-U.F. 600-volt. Pilot wires shall be a different color wire for each automatic controller. Common wires shall be white with a different color stripe for each automatic controller. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14.
   2. All splices shall be made with 3M, DBY/DBR direct bury splice kit, or approved equal. All connections shall be watertight.

N. Master Valve and Flow Sensor
   1. Master valve shall be the make and model as noted on the drawings. Size shall be as indicated on the drawings.

2. Master valve shall be normally open.
3. Flow sensor shall be the make and model as noted on the drawings. Size shall be as indicated on the drawings.

O. Master Valve and Flow Sensor Cable
1. Master valve cable shall be direct burial copper wire. Minimum size 14 gauge. Cable colors shall be red and white.
2. Flow sensor cable shall be twisted and shielded cable. Minimum size 16 gauge.

P. Gate Valves
1. Gate valves shall be the make and model as noted on the drawings.

Q. Quick Coupler Valves
1. Quick coupler valves shall be the make and model as noted on the drawings.

R. Electric Remote Control Valve Assembly Boxes
1. Control valve boxes shall be the make as noted on the plans with bolt down green cover, or approved equal. Install extensions if required.
2. Control valve and ball valve shall be placed in individual boxes.
3. Install multiple valve boxes at each location as needed to accommodate equipment.

S. Irrigation Heads and Drip
1. Shall be of the same manufacturer, type, size and deliver the same rate of precipitation with the same pressure, and discharge as indicated on Drawings and/or specified herein or approved equal.
2. Sprinkler bodies shall be Hunter brand with factory installed check valves.
3. Nozzles shall be Hunter brand as specified on the drawings.

T. Irrigation Controller
1. Irrigation controller shall be the make and model listed on the drawings.
2. Controller enclosure shall be as noted on the drawings.

U. Controller Station Number Identification Tag:
1. Standard yellow I.D. tags by:
Christy Enterprises
1207 W. Struck Avenue
Orange, California 92667
(717) 771-4142
(800) BLU-GLUE

PART 3 - EXECUTION

3.1 Observation of Site

A. Site Conditions
1. All scaled dimensions are approximate. The Contractor shall check and verify all site dimensions and notify the Project Inspector if site conditions have changed.
2. The Contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work on the irrigation system.
3. Contractor responsible for review of existing sprinkler/emitter layout and adjustments necessary to provide head-to-head coverage for all new configurations.

3.2 Preparation

A. Physical Layout
1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads.
2. All layout shall be approved by the Project Inspector prior to installation. If equipment is incorrectly located without said approval, it is the Contractor's responsibility to relocate it as per the Project Inspector's directions without additional cost.
3. Irrigation layout shall be installed to conform to new configuration of hardscape modified adjacent to work limits.

3.3 Water And Electrical Services

A. Water Supply
1. Irrigation system shall be connected to the water supply point of connection as indicated in the Drawings. Verify the connection point in the field. The contractor is responsible for any changes caused by actual site conditions. Notify Project Inspector in writing of any discrepancies prior to beginning construction.

2. Attach trace wire to mainline.

3. Contractor shall verify available flow and pressure. Notify Project Inspector if actual flow and pressure differ from what is shown on the Drawings.

B. Electrical Supply
1. Utilize electrical connection from the electrical drawings for the irrigation controller.
2. The Contractor is responsible for minor changes caused by actual site conditions and for the coordination of connection to the existing service.
3. Any electrical work and materials shall conform to local codes, ordinances and governing authorities having jurisdiction.

3.4 Installation

A. Trenching
1. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout indicated on the Drawings and as noted.
2. Provide for a minimum of eighteen (18) inches cover for all pressure lines.

3. Provide for a minimum of twelve (12) inches cover for all non-pressure lines.
4. Provide for a minimum of eighteen (18) inches cover for all control wiring.
5. Provide for a minimum of twenty-four (24) inches of cover for all pressure and non-pressure lines under auto circulation areas.

B. Backfilling
1. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

2. Where excavated native soil contains greater than 50% rock or other material one (1) inch diameter or larger, import clean backfill or sand bedding shall be placed three (3) inches in depth around all pipes.

3. If settlement occurs and subsequent adjustments in pipe, valves, drip or planting, or other construction are necessary, the Contractor will make all the required adjustments without cost to the Owner.

C. Trenching and Backfilling Under Paving

1. Trenches located under areas where paving, asphaltic concrete or concrete shall be installed, shall be backfilled with sand (a layer six (6) inches below the pipe and three (3) inches above the pipe and compacted in layers to 90% compaction, using manual or mechanical tamping devices). All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, cap and pressure test all piping under paving prior to the paving work.
2. Generally piping under existing walks is done by jacking, boring or hydraulic driving, but where any cutting or breaking of sidewalks and/or concrete is necessary, it shall be done and replaced by the Contractor as part of the Contract cost. Permission to cut or break sidewalks and/or concrete shall be obtained from the Owner. No hydraulic driving shall be permitted under concrete paving.

D. Sleeving/Conduit
1. Install all irrigation sleeving and electrical conduit at all hardscape crossings as indicated on the Drawings. Coordinate the installation of sleeving and conduit with the work of other trades as required.
2. Pipe size for sleeving shall be 2x the size of the pipe to be sleeved. The minimum size for sleeving shall not be less than 1.5”.
3. Pipe size for controller wire conduit shall be a minimum of 1”.

E. PVC Pipe
1. Routing of irrigation pipe as indicated on the Drawings is diagrammatic. Install lines and various assemblies to conform with the details shown on the Drawings.
2. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
3. PVC pipe shall be installed so that there will be a small amount of excess length in the pipe to compensate for contraction and expansion of the pipe. This shall be accomplished by "snaking" the pipe in the trench during installation.

F. Line Clearance
   1. All lines shall have a minimum clearance of three (3) inches from each other and twelve (12) inches from lines of other trades. Parallel lines shall not be installed directly over one another.

G. Automatic Controller
   1. Install the controller as indicated on the drawings and per manufacturer's specifications.
   2. The controller shall be mounted securely in the location noted on the drawings. Final location shall be approved by the owner.
   3. Final location shall be installed so that normal operation and access to the controller be easily accessed.
   4. The Contractor shall take all control wires to the controller and make all required connections for their installation. Connect station valves, common wire, master valve, and flow sensor wires to appropriate ports on the controller per manufacturers specifications.
   5. Any electrical and/or control wires installed above ground shall be placed in conduit or and securely mounted. Paint conduit to match the adjacent building or wall color.

H. Control Wiring
   1. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.
   2. Use caution when trenching through existing planter areas when connecting to the existing controller. Repair damage to existing planting and/or irrigation back to original conditions. Bore under existing hardscape to install wire in conduit (as necessary).
   3. Where more than one (1) wire is placed in a trench, the wiring shall be taped together at intervals of ten (10) feet.
   4. An expansion curl shall be provided within three (3) feet of each wire connection. Expansion curl shall be 18 inches in length at each splice connection and at each electric control, so that in case of repair, the valve bonnet may be brought to the surface without disconnection of the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.
   5. All control wire splices shall be completely waterproof. Use one splice per connector sealing pack.
   6. Size of wire shall not exceed manufacturer's length of run charts.

I. Electric Remote-Control Valves
   1. Install per the irrigation details and manufacturer's specifications.
   2. Locate valve boxes 12 inches from walk, curb, header board, etc., for easy access.
   3. Install one (1) remote control valve per valve box. Installation shall occur to allow for ease of access for all components within each valve box.
   4. Provide multiple valve boxes if necessary to fit all equipment within each valve boxes f.
   5. Install extension units as required. Install valve boxes in shrub planting areas whenever possible.
   4. Provide eighteen (18) inch expansion loop at all electrical connections within control valve boxes.

J. Flushing of System
   1. After all new irrigation pipe, lines and risers are in place and connected, all necessary diversion work is complete, and prior to installation of irrigation heads, the control valves shall be opened and a full head of water shall be used to flush out the system.

K. Drip System
1. Install all components per standard practice for drip irrigation, manufacturer's specifications, and plan details and notes.
2. Adjust the final location of the drip system per field conditions to adequately provide water to each plant as shown on the plans.
3. Flush all pipe for each zone prior to the installation of drip emitters.

L. Pop-Up Sprinklers
1. Install all pop-up sprinklers as detailed on the drawings, plan details, sheet notes and callouts.
2. Spacing of heads shall not exceed the distance indicated on the drawings and the irrigation legend.
3. Install turf sprinklers adjacent to fixed objects such as landscape edging, header boards, concrete curbs or mow strips, to allow for edging and maintenance equipment to pass with ease minimize damage to the sprinkler. A 2" minimum clearance shall be provided at each sprinkler location.
4. Risers all pop-up sprinklers shall be the same size as the opening of the sprinkler head body.
5. Install all pop-up sprinklers with a factory installed internal check valve to eliminate low head drainage.
6. All pop-up sprinklers shall be set perpendicular to finished grades unless specifically otherwise noted on the plans.
7. Nozzles shall be installed as indicated on the plans and in accordance with the manufacturer's specifications.
8. Adjust the radius and angle pattern of all nozzles to provide head-to-head full coverage for all irrigated areas and to minimize overspray onto adjacent areas.

M. Pressure Relief Valve
1. Install as per plan details and manufacturer's specifications.

N. Controller Station Number Identification Tags: Fasten securely to each control valve.

O. Valve Box Branding: Brand top of valve box lid with 2" lettering per manufacturers specifications.

3.5 Field Quality Control

A. Adjustment Of The System
1. The Contractor shall adjust all pressure regulating devices on the remote-control valves.
2. The Contractor shall flush and adjust all irrigation for optimum performance and to prevent run-off onto walks, hardscape, roadways, and buildings.
3. If it is determined that adjustments in the irrigation equipment shall provide proper and more adequate coverage, the Contractor shall make such adjustments after written approval by the Project Inspector. Adjustments shall include changes and additions of drip lines, emitters, etc. as required without additional contract costs.
4. If it is determined that any irrigation equipment is improperly installed, then adjustments shall be made to conform to construction documents without additional contract costs.

B. Testing of Irrigation System

1. The Contractor shall request the presence of the Project Inspector at least 48 hours in advance of testing.
2. Test all pressure lines under hydrostatic pressure of 125 pounds per square inch prior to installation of remote-control valves.
3. Sustain pressure in lines for not less than two (2) hours. If leaks develop, replace joints and repeat test until entire system is proven watertight. At the end of the test the system shall be drained in the presence of the owner.
4. All hydrostatic tests shall be done only in the presence of the Project Inspector. Center load pipe in trench exposing all joints for pressure test. No pipe shall be backfilled until it has been observed, tested and approved in writing by the Project Inspector. Should any work be covered up before such observation and tests are completed, the Contractor shall, at his own expense, uncover the work; and after it has been observed, tested and approved, he then shall make all repairs with such materials as required to restore all work disturbed to original and proper condition.
5. Furnish necessary force pump and all other test equipment. All equipment shall be present during the test.
6. Provide testing to ensure that the work be performed allowed for remaining irrigation connected to or affected by new work remains operational.

3.6 Training

A. Personnel Training.
1. Contractor shall be responsible for the training of as many personnel as the Owner shall deem necessary.
2. Contractor shall be responsible for one closing and one opening of the system during the appropriate times of the year as part of the training of the Owner's personnel.
3. Contractor training shall include general trouble-shooting and operation of the system with reference to head, valve, and controller operation.

3.7 Maintenance

A. Provide maintenance as per SECTION 329900 - LANDSCAPE MAINTENANCE.

3.8 Clean-Up and Observation Prior To Final Acceptance

A. Clean-up shall be made as each portion of work progresses. Trash, debris and excess dirt shall be removed from site. All walks and paving shall be broomed or washed down, and any damage sustained to the work of others shall be repaired to original conditions acceptable to the Owner.

B. Maintenance shall include, in addition to initial start-up, one Spring start-up. Re-set heads up to two times if necessary.

c. The Contractor shall operate each system in its entirety for the owner at time of final observation. Any items deemed not acceptable shall be reworked at no additional contract cost, to the complete satisfaction of the owner.

END OF SECTION

SECTION 329300 - PLANTING INSTALLATION

PART I - GENERAL

1.1 Scope Of Work

A. Furnish all labor, material, equipment and services necessary to provide all landscape work, complete in place, as indicated on Drawings and specified herein.

Work specified in this Section, but is not limited to the following:

1. Soil preparation
2. Planting
3. Clean-up

1.2 Quality Assurance

A. Source Quality Control

1. Submit documentation to the Project Inspector at least thirty (30) days prior to start of planting that all plant material has been ordered. Arrange procedure for observation of plant material with the Project Inspector at time of submission.

2. Plants shall be subject to observation and approval of the Project Inspector upon delivery for conformity to specifications. Such approval shall not impair the right of observation and rejection during progress of the work.

1.3 Product Delivery, Storage And Handling

A. Delivery

1. The Contractor, upon request by the Project Inspector, shall provide receipts, delivery tickets, load tickets, etc. of all items delivered to the job site to verify products and total quantities.

2. Deliver fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name trademark, and conformance to State Law.

3. Deliver plants with legible identification labels.
   a. Label trees, evergreens, bundles of containers of like shrubs, or ground cover plants.
   b. State correct plant name and size indicated on plant list.
   c. Use durable waterproof labels with water-resistant ink which will remain legible for at least sixty (60) days.

4. Protect plant material during delivery to prevent damage to rootball or desiccation of leaves.

5. The Contractor shall notify the Project Inspector forty-eight (48) hours in advance of delivery of all plant materials for observation.

B. Storage

1. Store plant material in shade and protect from weather.

2. Maintain and protect plant material.

C. Handling

1. Do not drop plant materials.

2. Do not pick up container plant material by stems or trunks.

1.4 Job Conditions

A. Planting: Perform actual planting only when weather and soil conditions are suitable in accordance with locally accepted practice.

B. Scheduling: Install trees, shrubs, and ground cover plant material areas after irrigation system is operable.

C. Protect work and materials from damage due to construction operations by other trades and vandalism. Maintain protection during construction and maintenance period.

1.5 Samples And Tests

The Project Inspector reserves the right to take and analyze samples of materials for conformity to specifications at any time; the Contractor shall furnish samples upon request by Project Inspector. Rejected materials shall be immediately removed from the site at the Contractor's expense. Cost of testing of materials not meeting specifications shall be paid by the Contractor.

1.6 Guarantee And Replacement

A. All plant material and other materials installed under the Contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship during installation and the maintenance period. Any plant found to be dead or not in a satisfactory or healthy condition due to faulty materials, workmanship, or improper maintenance as determined by the Project Inspector, shall be replaced by the Contractor at his expense. Trees shall be guaranteed for a period of one year.

B. Any materials found to be dead, missing or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The Project Inspector shall be the sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within fifteen (15) days of written notification by the Owner. All replacement materials and installation shall comply to the Drawings and the Specifications.

1.7 Submittals

A. The Contractor shall submit to the Owner's representative two (2) representative samples of bark mulch, soils report and the specified soil amendments (per soils report) with current (within the last 60 days) analytical data for approval by Owner's representative prior to any delivery of any of the above mentioned materials to the project site.

PART 2 - PRODUCTS

2.1 General

A. All materials shall be of standard, approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis. The Contractor shall supply the Project Inspector with a sample of all supplied materials accompanied by analytical data from an approved laboratory source illustrating compliance of bearing the manufacturer's guaranteed analysis.

2.2 Products

A. Soil Conditioner (for bidding purposes only).

1. Gro-Power Plus or approved equal: Humus (bacteria included based fertilizer and soil conditioner with soil penetrant shall consist of the following percents by weight:

5 %	nitrogen
3 %	phosphoric acid
1 %	potash
50 %	humus
15 %	humic acids

2. Actual product shall conform to soils test and recommendations of the analysis.

B. Soil Amendment (for bidding purposes only).

1. Base Bid soil amendment shall be:
   a. Nitrogen Stabilized Recycled Compost “Super Humus”: 0.56 to 0.84% N based on dry weight, treated with relative form of nitrogen (NH3).
      1) Particle Size: 95% - 100% passing 6.35 mm standard sieve.
         80% - 100% passing 2.33 mm standard sieve.
      2) Salinity: The saturation extract conductivity shall not exceed 3.5 millimhos/centimeter at 25 degrees (25°) centigrade as determined by saturation extract method.
      3) Iron Content: Minimum 0.08% dilute acid soluble Fe on dry weight basis.
      4) Ash: 0 - 6.0% (dry weight)
      5) Acidity range (pH) shall be between 5.5 and 7.5.
      6) Actual organic content shall be a minimum 280 pound (lbs.) per cubic yard.
2. Actual product shall conform to soils test and recommendations of the analysis.

C. Fertilizer (for bidding purposes only)

1. Planting Pit Fertilizer: Shall be Gro-Power Plus (bacteria included) with soil penetrant and shall consist of the following percents by weight:

   5% nitrogen
   3% phosphoric acid
   1% potash
   50% humus
   15% humic acid

2. Planting Tablets: Slow-release 21 gram tablets as manufactured by Agriform, containing the following percentages of nutrients by weight:

   20% nitrogen
   10% phosphoric acid
   5% potash

3. Soil Amendment NPK Fertilizer: Shall consist of the following percents by weight:

   6% nitrogen
   20% phosphoric acid
   20% potash

4. Actual products shall conform to soils test and recommendations of the analysis.

D. Plant Material

1. The plant material indicated on the Drawings by the listed names shall conform to "Standard Plant Names", second edition, except for names not covered therein, the established customs of the nursery trade is followed. All plants shall be true to name, above one of each bundle or lot shall be tagged with the name and size of the plant, in accordance with the standards of practice recommended by the American Association of Nurserymen. All plant materials shall meet the specifications of Federal, State and County laws, requiring observation for plant diseases and insect infestations. Plants shall be symmetrical, typical for variety and species, sound, healthy, vigorous, free from plant diseases, insect pests or other eggs, and shall have healthy, normal root systems, while filling their containers, but not to the point of being root bound. Use only plant materials that are first class representative of the species and cultivars specifies and that conform to all State and local laws governing the sale, transportation and observation of plant materials. Plants shall have straight, single trunks, unless otherwise specified on the plans. Those specified to be multi-trunk shall have at least three (3) main leaders from the base. Any and all plants that have any encircling roots (not root bound) shall have root balls lightly slashed on a minimum of three (3) sides to stop encircling root growth. The height and spread of all plant materials shall be measured with branches in their normal position. Sizes of plants shall be as stated on the plant list, five and fifteen (5 & 15) gallon can container stock shall have been grown in that container not less than six (6) months, but shall not have been overgrown in the containers so as to have become root bound.

2. The size of the plants will correspond with that normally expected for species and variety of commercially available nursery stock or as specified in the Special Conditions or Drawings. The minimum acceptable size of all plants, measured before pruning with the branches in normal position, shall conform with the measurements, if any, specified on the Drawings in the list of plants to be furnished. Plants larger in size than specified may be larger plants is approved, the ball of earth or spread of roots for each plant will be increased proportionally. Plant material shall conform to the following Specifications for container stock:

SHRUBS

SIZE	TYPE	EXAMPLE	HEIGHT	SPREAD	CALIPER
1 Gal.	low growing	Pitt. tobira - etc.	8-10"	6-8"	
1 Gal.	tall growing	Pitt. eugen. - etc.	10-12"	6-8"	
5 Gal.	low growing	Pitt. tobira - etc.	15-18"	15-18"	
5 Gal.	tall growing	Pitt. eugen. - etc.,	24-30"	15-18"	
TREES					
5 Gal.	slow growing	Quercus - etc.	5-6'	12-18"	1/4 - 1/2"
5 Gal.	fast growing	Euc. - Prunus - etc.	6-7'	12-18"	1/2 - 3/4"
15 Gal.	slow growing	Quercus - Pyrus - etc.	7-8'	24-30"	3/4 - 1"
15 Gal.	fast growing	Euc. - Prunus - etc.	8-10'	30-36"	1- 1 1/4"
24" Box	slow growing	Quercus - Pyrus - etc.	8-10'	3-4'	1 1/2-1 3/4"
24" Box	fast growing	Euc. - Prunus - etc.	10-12'	4-5'	1 3/4-2 1/2

3. All plants not conforming to the requirements herein specified, shall be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the work and replaced with new plants at the Contractor's expense. The plants shall be of the species, variety, size and condition specified herein or as shown on the Drawings. Under no conditions will there be any substitution of plants or sizes listed on the plans, except with the expressed written approval of the Project Inspector.

4. At no time shall trees or plant materials be pruned, trimmed or topped prior to delivery and any alteration of their shape shall be conducted only with the approval and when in the presence of the Project Inspector and/or as noted on the Planting Specifications.

5. Nursery Grown and Collected Stock
   a. Plant materials shall conform with the latest edition of ANSI Z60.1-1986 American Standard for Nursery Stock.
   b. Grown under climatic conditions similar to those in locality of project.
   c. Container-grown stock in vigorous, healthy condition, not root bound or with root system hardened off.
   d. Use only linear stock plant material which is well established in removable containers or formed homogeneous soil sections.

E. Tree Staking Material

1. Stakes for Tree Support

a. Wood Tree Stakes-Lodge pole pine stakes full-length. Minimum nominal size: two (2) inches in diameter x ten feet (2" x 10') long and pointed at one (1) end (adjust length to fit tree). Stakes shall be free from knots, checks, splits, or disfigurements.

2. Ties
   a. 24" length Cinch Tie as manufactured by V.I.T. Company.

F. Miscellaneous Materials

1. Sand: Wash river sand or equal.

G. Bark Mulch

1. Bark mulch shall be landscape grade shredded cedar from Redi-Gro Corporation.

H. Pre-Emergent

1. Pre-emergent to prevent annual weed development in hydromulch applications.

PART 3 - EXECUTION

3.1 Observation

A. Verify that final grades have been established prior to beginning planting operations. Inspect trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning. Do not begin planting of trees until deficiencies are corrected or plants replaced.

3.2 Preparation

A. Stake or mark with line locations for plants and outline of planting beds on ground. Do not begin excavation until plant locations and plant beds are acceptable to the Project Inspector. The irrigation system shall be operational and approved prior to planting.

B. All planting areas shall be weed free at the time of plant material installation.

3.3 Installation

A. Preparation of Planting Area

1. After approximate finished grades have been established, soil amendments shall be added per the recommendations of the soils report as noted on the plans. Amendments shall be uniformly spread and cultivated thoroughly by means of mechanical tiller into the top six (6) inches of soil.

   Application Rates (for bidding purposes only):
   a. One hundred fifty (150) lbs. of soil conditioner per 1,000 square feet.
   b. Three (3) cubic yards of soil amendment per 1,000 square feet.
   c. One hundred thirty (130) pounds of limestone per 1,000 square feet.

d. Soil Amendment NPK Fertilizer at a rate of 15 lbs. per 1,000 square feet.

Note: Actual rates shall conform to soils test and recommendations of the analysis.

2. All soil areas shall be compacted and settled by application of irrigation to a minimum depth of eight (8) inches.

3. At time of planting, the top six (6) inches of all areas to be planted shall be free of stones, stumps, or other deleterious matter one (1) inch in diameter or larger, and shall be free from all debris, or similar objects that would be a hindrance to planting and maintenance.

4. Soil Tests: A soils report shall be prepared as noted on the plans. Actual soil amendments shall be provided per the recommendations of the soil test and report.

B. Final Grades

1. Finished grading shall insure proper drainage of the site.

2. Finish grades shall be as noted on the civil plans.

3. Surface drainage shall be away from all building foundations.

4. Dispose of excess or unacceptable soil from the site.

3.4 Plant Installation

A. General

1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Project Inspector.

2. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.

3. Container shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Layout of Major Plantings

Locations for plants and outlines of areas to be planted shall be marked on the ground by the Contractor before any plant pits are dug. All such locations shall be approved by the Project Inspector. If an underground construction or utility line is discovered prior to work, other locations for planting may be selected by the Project Inspector.

C. Planting of Trees and Shrubs

1. Excavation for planting shall include the stripping and stocking of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits and planting beds.

2. Excess soil generated from the planting holes and not used as backfill or in establishing the final grades shall be removed from the site.

3. Excavating for Planting
   a. Shape
      1) Vertical sides and flat bottom.
      2) Plant pits to be square for box material, circular for canned material.
      3) Scarify sides and bottom of each pit.
   b. Size: All trees shall have planting pits dug twice the diameter of the rootball. Shrubs shall have planting pits dug two (2) times the diameter of the rootball. Backfill around the rootball with prepared backfill mix.
   c. Protect all areas from excessive compaction when trucking plants or other materials to planting site.
   d. Can Removal
      1) Cut cans on two (2) sides with an acceptable can cutter.
      2) Do not injure the rootball.
      3) Do not cut cans with spade or ax.
      4) Carefully remove plants without injury or damage to rootball.
      5) After removing plant, superficially cut edgeroots with knife on three (3) sides.
   e. Box Removal
      1) Remove bottom of plant boxes before planting.
      2) Remove sides of box without damage to rootball after positioning plant and partially backfilling.
   f. Center plant in pit.
   g. Face plants with fullest growth into prevailing wind.
   h. Set plant plumb and hold rigidly in position until soil has been tamped firmly around ball roots.
   i. Remainder of planting pit shall be backfilled with:
      1) Three (3) parts rock-free native soil.
      2) One (1) part nitrogen stabilized shavings.
      3) Two and one half (2-1/2) pounds 6-20-20 fertilizer per cubic yard of mix.
      4) Specified type and quantity of planting tablets.
   j. All plants which settle shall be raised to the correct level. After the plant has been placed, additional backfill shall be added to the hole to cover approximately one-half (1/2) of the height of the rootball. Water shall be added to the top of the partly filled hole to thoroughly saturate the rootball and adjacent soil.
   k. After the water has completely drained, planting tablets shall be placed adjacent to but not in contact with rootball per the recommendations of the soils analysis.
   l. The remainder of the hole shall be backfilled.
   m. After backfilling, an earthen basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least three (3) inches of water. Basin shall be of a size suitable for the individual plant. In no case shall the basin for fifteen (15) gallon plant be less than four (4) feet in diameter; a five (5) gallon plant less than three (3) feet in diameter. The basins shall be constructed of amended backfill materials, and shall not be constructed for trees in turf areas.

n. Pruning shall be limited to the minimum necessary to remove injured twigs and branches and to compensate for loss of roots during transplanting, but never to exceed one-third (1/3) of the branching structure. Upon approval of the Project Inspector, pruning may be done before delivery of plant, but not before plants have been observed and approved. Cuts over three-quarter (3/4) inch in diameter shall be painted with tree wound paint.

o. Staking
   1) Staking of all trees shall conform to tree staking and tree planting details.
   2) One (1) tree of each size shall be staked and approved by the Project Inspector prior to continued staking.

D. Weed Control

1. Apply weed control to all planter areas after completion of all planting and one (1) complete watering (to "set" plants). Apply as per manufacturer's specifications.

E. Mulch Cover

1. All planting areas shall be dressed with a three (3) inch layer of mulch per plans.

3.5 Clean Up

After all planting operations have been completed, remove all trash, excess soil, empty plant containers or 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 neat and orderly condition throughout the site. Contractor shall pick up all trash resulting from this work no less frequently than each Friday before leaving the site, once a week, and/or the last working day of each week. All trash shall be removed completely from the site. The Contractor shall leave the site area broom-clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition acceptable to Owner and Project Inspector.

3.6 Observation Schedule

A. The Contractor shall be responsible for notifying the Project Inspector in advance for the following observations according to the time indicated:

1. Plant layout review - 72 hours.

2. Soil preparation and planting operations. One (1) tree with each type of specified staking shall be approved prior to planting of trees - 72 hours.

3.7 Landscape Maintenance

Provide Landscape Maintenance as per SECTION 329900 - LANDSCAPE MAINTENANCE.

END OF SECTION

SECTION 329900 - LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.1 Scope Of Work

A. Furnish all labor, material, equipment and services required to maintain landscape in a healthy growing condition and in a neat and attractive appearance throughout the maintenance period.

1.2 Quality Assurance

A. The Maintenance Contractor shall be experienced in horticulture and landscape maintenance, practices and techniques, and shall provide sufficient number of workers with adequate equipment to perform the work during the maintenance period.

1.3 Maintenance Period

A. Continuously maintain the entire project area during the progress of the work and during the one hundred and twenty (120) working days, maintenance period or until final acceptance of the project by the Owner.

B. Maintenance period shall not start until all elements of construction, planting and irrigation for the entire project are in accordance with Plans and Specifications. A prime requirement is that all landscape areas shall be weed free and planted and growing in a healthy vigorous rate. If such criteria is met to the satisfaction of the project inspector, a written notification shall be issued to establish the effective beginning date of maintenance period.

C. Any day of improper maintenance, as determined by the project inspector, shall not be credited as an acceptable maintenance period day. The maintenance period shall be extended on a daily basis if the work is not in accordance to the plans and specifications.

D. Maintenance shall continue beyond the one hundred and twenty (120) working days maintenance period, as required, until final acceptance is given by the owner.

E. At a minimum contractor is responsible to provide a site inspection of plantings and review of the irrigation system on a weekly basis. Provide written reports detailing findings of the site inspections.

F. Contractor shall provide protection to the project site during the maintenance period.

1.4 Guarantee And Replacement

A. All plant material and other materials installed under the Contract shall be guaranteed for the duration of the landscape maintenance period against any and all poor, inadequate or inferior materials and/or workmanship or improper maintenance, as determined by the project inspector, shall be replaced by the Contractor at his expense. Trees shall be guaranteed for a period of one year.

B. Any materials found to be dead, missing, or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The project inspector shall be sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within five (5) days of written notification by the Owner. All replacement materials and installations shall comply to the Plans and Specifications. Any plant missing due to suspected theft shall be replaced by the Contractor. If the Contractor suspects that theft may be a problem, the Contractor shall provide written documentation to the Owner that security on this site needs to be intensified. The Contractor may relieve himself of theft responsibility if after the security notice, with no result, a written notice to the Owner shall be given that plant material will not be replaced for theft or vandalism due to lack of site security being maintained. This procedure may take place only during the Landscape Maintenance Period.

1.5 Final Acceptance Of The Project

A. Upon completion of all project work, including maintenance period, the Project Inspector will, upon proper request, make an observation to determine final project acceptability.

B. Where observed work does not comply with the Plans and Specifications, replace rejected work and continue specified maintenance period until reinspected by the Project Inspector and determined to be acceptable. All replacement materials and installations shall be in accordance with the Plans and Specifications. Remove rejected work and materials immediately from project. Prior to the date of final observation, Contractor shall provide the Owner with all Record Drawings and written Guarantee Statement in accordance with the Plans and Specifications.

PART 2 - PRODUCTS

2.1 Materials

A. All materials used shall be typical for landscape maintenance practice.

B. Maintenance fertilizer shall be per the recommendations of the soils report.

PART 3 - EXECUTION

3.1 Maintenance

A. Maintenance shall be according to the following standards. All areas shall be weeded and cultivated at intervals of not more than seven (7) days. Watering, trash and debris removal, mowing, rolling, edging, trimming, fertilization, spraying and pest control, as required, shall be included in the maintenance period. Street gutters and sidewalks shall be included. The Contractor shall be responsible for maintaining adequate protection of the area. Damaged areas shall be repaired at the Contractor’s expense. Between the 15th day and the 20th day of the maintenance period, the Contractor shall re-plant shrubs and/or trees that appear to be in distress or where proficient growth is not evident.

B. During course of maintenance, excess and waste materials shall be continuously and promptly removed at end of each workday.

C. Water in such manner and as frequently as is deemed necessary by Owner to assure continued growth of healthy grass. Water areas of site in such a manner as to prevent erosion due to excessive quantities applied over small areas and to avoid damage to finished surface due to watering equipment.

3.2 Tree And Shrub Care

A. Watering

1. Maintain a large enough water basin around plants so that enough water can be applied to establish moisture through the major root zone. When hand watering use a water wand.

B. Pruning

1. Shrubs:
   a. Under no circumstances shall shrubs be clipped into balled or boxed forms.
   b. All pruning cuts shall be made to lateral branches or buds or flush with the trunk. "Stubbing" will not be permitted.

C. Staking

1. Stakes shall remain in place through acceptance and are to be inspected to prevent girdling of trunks or branches and to prevent rubbing that causes bark wounds.

D. Weed Control

1. Keep area between plants free of weeds. Use recommended, legally approved herbicides. Avoid frequent soil cultivation that destroys shallow roots. Use mulches to help prevent weed germination.

E. Fertilization

1. Fertilize all planting areas per the recommendations of the soil test.

2. Avoid applying fertilizer to the root ball and base of main stem; rather, spread evenly under plant to drip line. Rates will vary from about a cup of nitrate fertilizer (depending on nitrogen percentage) around a newly installed small plant to about one-half (1/2) lb. of actual nitrogen per inch of trunk diameter measured four feet from the ground for mature trees.

G. Replacement of Plants

1. Replace dead, dying and missing plants with plants of a size, condition and variety to match plans acceptable to Owner at Contractor's expense under the conditions stated in the Guarantee and Replacement section of these specifications.

3.3 Ground Cover Care

A. Weed Control

1. Maintain all areas free from weeds and undesirable grasses. Control weeds, preferably with pre-emergent herbicides, but also with selective systemic herbicides. Hoe weeds as little as possible since this may result in plant damage.

B. Watering

1. Water enough that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.

C. Trash

1. Remove trash and debris weekly. Dispose in a legal manner.

D. Edging and Trimming

1. Edge ground cover to keep in bounds and trim growth as necessary to achieve an overall even appearance.

E. Replacement

1. Replace dead and/or missing plants at Contractor’s expense per the conditions stated in the Guarantee and Replacement section of these Specifications.

3.4 Irrigation System

A. System Observation

1. The Contractor shall check all systems for proper operation. Lateral lines shall be flushed out by removing the last sprinkler head at each end of the lateral. All heads are to be adjusted as necessary for unimpeded, head to head coverage.

B. Controllers

1. Set and program automatic controllers for seasonal water requirements. Give the Owner's representative instructions on how to turn off system in case of emergency.

C. Repairs

1. Repair all damages to irrigation system at the Contractor's expense. Repairs shall be made within twenty-four (24) hours.

END OF SECTION

SECTION 33 00 00 – SITE UTILITIES

PART 1 - GENERAL

1.1 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.2 SCOPE OF WORK

A. The work includes, but is not necessarily limited to, the following:
   1. Domestic water piping system.
   2. Fire protection piping systems.
   3. Sewer piping system.

B. Other items that may be specified or shown on the Drawings.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33, Trenching and Backfilling.

B. Section 32 16 00, Site Concrete.

C. Section 33 00 00, Earthwork.

1.4 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the drawings to be salvaged and re-used.
   1. Sun damaged or discolored PVC pipe will be rejected.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects or deficiencies discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.

D. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction or incorrect grades will be the responsibility of the contractor.

E. Per 2022 NFPA 13 provide Contractor's material and test certificate to the Owner, Architect, Project Inspector and Local Fire Authority.

1.5 SUBMITTALS

A. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

B. Provide sieve analysis from accredited testing lab on pipe bedding material. Analysis shall have a current date not older than project contract signing date.

C. Substitution: Provide all data of proposed material being submitted as a substitution. Provide comparison with specified product data and identify all differences. Failure to provide comparison will be reason for rejection.

1.6 FEES, PERMITS, AND UTILITY SERVICES

A. Obtain and pay for permits and service charges required for installation of Work. Arrange for required inspections and secure written approvals from authorities having jurisdiction.

B. Upon completion of work within right-of-way, provide copies of written final approval to the Architect.

1.7 WARRANTY

A. Refer to General Conditions.

1.8 REFERENCES AND STANDARDS

A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.

C. ANSI/ASTM D1557-02 - 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.

D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).

E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

F. CALTRANS Standard Specifications.

G. CAL-OSHA, Title 8, Section 1590 (e).

H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

I. NFPA 13, 24 and 25, latest editions.

J. California State Health and Safety Code Section 116875, Lead Free Public Water Systems.

K. California Plumbing Code, latest edition.

1.9 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.10 PROJECT CONDITIONS

A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.

1.11 EXISTING SITE 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.

1.12 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, the Contractor shall be solely and completely responsible for working conditions at the job site, 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. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures,

in, on, or near the construction site.

D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to provide pumps and all equipment necessary to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. 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.

H. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

1.13 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.14 RECORD DRAWINGS

A. Keep a daily record of all pipe placed in ground, verified by Project Inspector.

B. Upon completion of this Contract, furnish one tracing showing all outside utility lines, piping, etc., installed under this Contract. Locate and dimension all work with reference to permanent landmarks.

C. All symbols and designations used in preparing "RECORD" drawings shall match those used in Contract drawings.

D. Properly identify on as-builts and provide dimensions for all stubs for future connections. Provide concrete markers 6” dia. 12” deep, flush with finish grade at the ends of all stubbed pipes.

PART 2 – PRODUCTS

2.1 MATERIALS - GENERAL

A. Provide each item listed herein or shown on drawings of quality noted or approved equal. All material shall be new, full weight, standard in all respects and in first-class condition. Insofar as

possible, all materials used shall be of same brand or manufacture throughout for each class of material or equipment.

B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein.

C. Dimensions, sizes, and capacities shown are minimum and shall not be changed without permission of Architect.

D. All materials in this section used for any public water system or domestic water for human consumption shall be lead free.
   1. For the purposes of this section, “lead free” means not more than 0.2 percent lead when used with respect to solder and flux and not more than 8 percent when used with respect to pipes and pipe fittings.
   2. All pipe, pipe or plumbing fitting or fixtures, solder, or flux shall be certified by an independent American National Standards Institute (ANSI) accredited third party, including, but not limited to, NSF International, as being in compliance with this section.

E. All materials used for fire system piping shall be UL and FM approved.

2.2 VALVE BOXES

A. Provide at each valve or cock in ground a Christy, Brooks, or equal to Christy G05CT, concrete valve box with cover marked for service, domestic water shall be marked “Water” and fire supply shall be marked “Fire”. Furnish extension handles for each size square nut valve, and provide “fork” handle for each size of “wheel handle” valve as required. Do not locate valve boxes in walk, or covered passages, curbs, or curb & gutters, unless necessary. If valve location is within concrete or asphalt paved surface valve box shall be as detailed on plans for such condition. Provide valve box extensions as required to set bottom of valve box to bottom of piping in which valve is installed. Provide Owner with set of special wrenches and/or tools as required for operation of valves.

2.3 PIPES AND FITTINGS

A. Sanitary Sewer: PVC sewer pipe and fittings with Ring-Tite joints, ASTM D3034 SDR35.

B. Domestic water Lines 3 1/2” and smaller: Schedule 80 PVC.

C. Water lines 4” and larger: AWWA C-900 Class 150/DR18 with rubber gasket joints.

D. Fire lines 4” and larger: AWWA C-900 Class 200/DR14 with rubber gasket joints.

E. Solder: Lead Free. 95/5; 95% Tin / 5% Antimony.

F. Ductile Iron Pipe; Class 350, Cement Lined

G. Ductile Iron Pipe Fittings; AWWA C110, C153, Ebba Iron, Star Romac, Sigma, or approved

equal.

H. Mechanical Fitting Bolts; Bolts and nuts shall be carbon steel with a minimum 60,000 psi tensile strength conforming to ASTM A 307, Grade A. Bolts shall be standard ANSI B1.1 Class 2A course threads. Nuts shall conform to ASTM A 563 and be standard ANSI B1.1, Class 2A course thread. All bolts and nuts shall be zinc coated.

I. Fasteners Anti-Rust Coatings; After assembly, coat all fasteners with an Asphaltic Bituminous coatings conforming to latest edition NFPA 24.

J. Ductile Iron Pipe Wrap; 8 mil polyethylene pipe wrap conforming to ANSI/AWWA C105/A21.5 standards.

K. Pipe Insulation; Pipe exposed to atmospheric conditions ½" thru 4" NPT; Johns Manville rigid fiberglass insulation, Micro Lok HP; Owens Corning Fiberglas SSL II; Conforming to ASTM C 612, Type 1A or type 1B.

L. Aluminum field applied pipe insulation jacket; comply with ASTM B209, ASTM C1729, ASTM C1371 Manufacturers; Childers Metals; ITW Insulation Systems Aluminum Jacketing; or an approved equal.
1. Finish shall be flat mill finish
2. Factory Fabricated Fitting Covers; 45 and 90 degree elbows, tee's, valve covers, end caps, unions, shall be of the same thickness and finish of jacket.
3. The fittings shall be composed of 2-pieces
4. Adhesives; per the manufacturers requirements
5. Joint Sealant; shall be silicone, and shall be aluminum in color.

M. Sewer Forced Main; HDPE, DR 11, color gray with green stripe by JM Eagle or approved equal.

2.4 SANITARY SEWER MANHOLES

A. Shall be constructed as shown on plan details.

2.5 CLEANOUTS

A. Cleanouts of same diameter as pipe up to 8" in size shall be installed in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18" from building so as to provide sufficient space for rodding. No horizontal run over 100 feet shall be without cleanout whether shown on drawings or not.

B. All cleanout boxes shall be traffic rated with labeled lid, Christy G05CT or approved equal. Lid shall be vandal proof with stainless steel screws

2.6 UNIONS

A. Furnish and install one union at each threaded or soldered connection to equipment and 2 unions, one on each side of valves on pipes ½" to 3".

B. Locate unions so that piping can be easily disconnected for removal of equipment or valve. Provide type specified in following schedule:

Type of Pipe Union	
Steel Pipe:	150 lb. Screwed malleable ground joint, brass, brass-to-iron seat, black or galvanized to match pipe.
Copper tubing:	Brass ground joint with sweat connections.
PVC Sch 80 pipe:	PVC union, FIPT X FIPT

2.7 VALVES

A. Provide valves as shown and other valves necessary to segregate branches or units. Furnish valves suitable for service intended. Valves shall be properly packed and lubricated. Valves shall be non-rising stem. Place unions adjacent to each threaded or sweat fitting valve. Install valves with bonnets vertical. All valves shall be lead free.

B. Valves ½" thru 2"; shall be made of bronze, full size of pipe and lead free. Nibco S-113-FL Series; American G-300 Series; Matco 511 FL Series; Apollo 102T-FL Series. Brass valves of brass parts within valves will not be accepted.

C. Valves, 2 ½" thru 3" shall be class 150; Shall be made of bronze, full size of pipe; Jenkins Fig. 2310 J; Lunkinheimer Fig. 2153; Crane Fig. 437; Stockham Fig. B-128.

D. Valves, Flanged; 4" thru 12" Ductile Iron Resilient Wedge Gate Valve; Nibco F 609 RW; American 2500 Series; Kennedy 8561; Mueller 2360 Series.

2.8 FIRE HYDRANTS

A. Clow 960 Factory Painted or per Local Jurisdiction Requirements, or an approved equal, 36" minimum bury, two 2-1/2" hose nozzles, one 4-1/2" pumper nozzle, and break-off check valve, Clow LBI 400A or approved equal . Hydrant shall conform to, and installation shall comply with the Local Jurisdiction.

2.9 POST INDICATOR

A. Post Indicator shall be Mueller Co. A-20806 (adjustable) with tamper switch or an approved equal.

2.10 BACKFLOW PREVENTERS

Double Check Valve, Double Check Detector and Reduced Pressure Backflow Preventers

A. Backflow preventers shall be as approved by the local agency and by the State of California's Department of Health Services most recent list of approved reduced pressure backflow preventers. All approved backflow preventers shall have ductile iron bodies.
   1. Provide Backflow preventer blankets with locking device. Weatherguard R-30 insulated or equal.
   2. Provide ball valve at all test ports with brass plug in valve.
   3. Provide a minimum of 2 valve tamper switches on fire prevention Backflows.

2.11 TAPPING SLEEVE

A. Shall be used on pipe sizes 6" thru 12" and shall be made with stainless steel material including stainless steel bolts. Flanges shall be ductile iron or high carbon steel. Gaskets shall seal full circumference of pipe. Shall be manufactured for operating pressure of 200 psi, and shall pass test pressure of 300 psi. Romac SST series; Smithblair 662; Mueller H304; Ford "FAST" tapping sleeve.

2.12 SERVICE SADDLES

A. Shall be used on pipe size 2" thru 4". Body shall be made from ductile iron with epoxy coating or bronze. Cascade Style CSC-1; A.Y. McDonald model 3891 AWWA/3892 FNPT; Smith-Blair #317; Ford S70, S71, S90, (style B).

2.13 TRACER WIRE

A. No. 10 solid copper wire with insulated with LLDPE 30 mil, HMWPE 45 mil. Solder all joints

PART 3 - EXECUTION

3.1 DRAWINGS AND COORDINATION

A. General arrangement and location of piping, etc., are shown on Drawings or herein specified. Install work in accord therewith, except for minor changes that may be necessary on account of other work or existing conditions. Before excavation, carefully examine other work that may conflict with this work. Install this work in harmony with other craft and at proper time to avoid delay of work.

B. Verify invert elevations at points of connection to existing systems prior to any excavation. If invert elevations differ from that shown on drawings, notify Architect immediately.

C. In advance of construction, work out minor changes if conflicts occur with electrical or mechanical. Relocate services to suit actual conditions and work of other trades to avoid conflict therewith. Any adjustments or additional fittings to make adjustments shall not be cause for additional costs to the owner.

D. Execute any work or apparatus shown on drawings and not mentioned in specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor of furnishing same in place complete.

E. Graded pipes shall take precedence. If conflict should occur while placing the domestic water and fire service piping, the contractor shall provide any and all fittings necessary to route the water lines over or under such conflicting pipes at no additional costs to the owner.

3.2 ACCESS

A. Continuously check for clearance and accessibility of equipment or materials specified herein to be placed. No allowance of any kind shall be made for negligence on part of Contractor to foresee means of installing his equipment or materials into proper position.

3.3 EXCAVATING AND BACKFILLING

A. Excavation and Bedding:
1. General: Trench straight and true to line and grade with bottom smooth and free of irregularities or rock points. Trench width to be a minimum of 12" wider than outside diameter of pipe. Follow manufacturer's recommendations for use of each kind and type of pipe.
2. Bedding: Provide a bedding as noted on drawing details for the full length of the pipe. Bedding shall have a minimum thickness beneath the pipe of 4" or 1/8 the outside diameter of the pipe, which ever is greater. Provide bell holes and depressions for pipe joints only of size required to properly make joint.

B. Laying of Pipe:
1. General: Inspect pipe prior to placing. Sun damaged pipe will be rejected. Set aside any defective or damaged material. Do not place pipe in water nor place pipe when trenches or weather are unsuitable. Lay pipe bell upgrade, true to line and grade.
   a. Sewer pipe shall be laid in strict conformity to the prescribed line and grade, with grade bars set and each pipe length checked to the grade line. Three consecutive points on the same rate of slope shall be used at all times to detect any variation from a straight grade. In any case of discrepancy, work shall be stopped and the discrepancy immediately reported to the Owner’s Representatives. In addition, when requested by the Owner's Representative, a string line shall be used in the bottom of the trench to insure a straight alignment of the sewer pipe between manholes. The maximum deviation from grade shall not be in excess of 1/4 inch. In returning the pipe to grade, no more than ¼” depression shall result.
   b. The Contractor shall expose the end of existing pipe to be extended, for verification of alignment and elevation, prior to trenching for any pipe which may be affected. All costs of such excavation and backfill shall be included in the price paid for the various items of work.
   c. A temporary plug, mechanical type shall be installed on sewer pipe at the point of connection to existing facilities. If connecting to a public facility the plug shall conform to the requirements of the local jurisdiction. This plug shall remain in place until the completion of the balling and flushing operation.
2. Bell and Spigot Joints: Lubricate inside of bells and outside of spigots with soap

solution. Wedge joints tight. Bell of bell and spigot pipe to be pointed upgrade.

C. Backfilling:
1. General: Do not start backfill operations until required testing has been accomplished.
2. Compaction and Grading: Remainder of backfill shall be in accordance with Section 31 23 33 – TRENCHING AND BACKFILLING.
3. If trenching in area previously lime or cement treated backfill top of trench section, same depth as lime or cement treatment with Class 2 Aggregate Base compacted to 95% minimum relative compaction.

3.4 INSTALLATION OF WATER PIPING

A. The contractor shall be responsible for determining the installed depth of all water piping, based on surfaces grades and minimum required depth of cover.

B. Immediately cap or plug ends of, and opening in, pipe and fittings to exclude dirt until final connections made. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.

C. General: Should existing conditions or other work prevent the running of pipes or the setting of equipment at the points indicated by drawings, changes as authorized by the Architect shall be made without additional cost to the Owner.

D. All bolts used on mechanical fittings shall be thoroughly coated with an asphaltic bituminous coating conforming to 2022 NFPA 24, 10.4.1.1.

E. All buried metal shall be incased with 8 mil polyethylene wrap so that no soil is in contact with metal. Ends of polyethylene wrap shall be taped to provide seal with pipe.

F. Do not install water lines in same trench with non-metallic sewer lines unless bottom of water pipe at all points is at least 12" above top of sewer line and water line is placed on solid shelf excavated at one side of common trench with a minimum of 12 inch horizontal separation.

G. Under no circumstance shall a fitting be located directly under a structural footing without prior approval from the Architect.

H. In locations where existing domestic pipe is rerouted, the new pipe shall be assembled using restrained fittings at all joints including factory pipe joints. Tapped restrained blind flanges shall be temporarily installed at each end of the assembled pipes until testing and chlorination is completed and approved.

3.5 CLOSING IN OF UNINSPECTED WORK

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected, tested, and approved. Should work be enclosed or covered up before it has been approved, uncover work at own expense. After it has been inspected, tested and approved, make repairs necessary to restore work of other contractors to condition in which it was found at time of

cutting.

3.6 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in new condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures and trim that are installed as part of this work. Leave systems and equipment in satisfactory new operating condition.

B. Drain and flush piping to remove grease and foreign matter.

C. Sewer piping shall be balled and flushed.

D. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.

E. Flush fire service piping in the presence of the project inspector. Flushing shall be continued for a sufficient time as necessary to ensure all foreign material has been removed. Flow rate shall be equal to site fire flow requirements.

3.7 SEWER INTERNAL INSPECTIONS

A. 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 resulted from the new installation, shall also be removed. Pipes shall be cleaned by the controlled balling and flushing 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.

3.8 TEST OF PIPING

A. Pressure Test piping at completion of roughing-in, in accord with following schedule, and show no loss in pressure or visible leaks after minimum duration or four (4) hours at test pressures indicated.

B. Chlorination tests shall be performed after all fixtures and any required mechanical devices are installed and the entire system is complete and closed up.

C. In cases where new domestic water piping is assembled for re-routing of existing domestic water pipe, the contractor shall perform the following testing prior to connecting the new water pipe to the existing system.
   1. The pipe shall be pressure tested and per the test schedule.
   2. The pipe shall be pressure tested down within the trench.
   3. The contractor shall dig a temporary ditch below the existing pipe to drain to a sump that is lower than the bottom of the trench and to the side of the trench. The sump shall be 30% larger than the total volume of water within the testing pipe assembly.

4. After pressure testing and chlorination has taken place and accepted, the contractor shall drain the pipe into the sump and pump the sump out as it is filling.
5. The temporary test fittings at each end of the pipe assembly shall be removed and the final restrained couplings installed.
6. The existing piping shall be cut and the water within the pipe shall drain below the pipe to the temporary sump. Pump the sump as it is being filled up. Take extreme caution not to contaminate the existing pipe with any contaminates within the trench.
7. Before making the final coupling connections, the restrained couplings at each end of the new pipe shall be thoroughly swabbed inside the fitting with a solution of chlorine mixed with water at a rate of 1part chlorine to 4 parts potable water.
8. After final connections are made, a visual inspection shall be made after fittings are wiped off. If after 1 hr, no noticeable drips are noted the pipe can be backfilled.
9. The contractor shall flush all water piping affected by chlorination until it is within acceptable levels approved by certified testing lab.

TEST SCHEDULE

System Tested	Test Pressure PSIG Test With
Public water mains	Per local jurisdiction requirements.
Private domestic water piping and fire mains serving fire hydrants:	150 Lbs. Water 4 hrs.
Fire Protection Piping from PIV to fire riser:	200 Lbs. Water pressure, 4 hrs duration with no pressure loss.
Sanitary Sewer Piping:	Sewer system shall be tested for leakage per local jurisdiction requirements.

D. Testing equipment, materials, and labor shall be furnished by contractor.

3.9 WATER SYSTEM STERILIZATION

A. Public Water Mains: Shall be flushed and disinfected per the local jurisdiction requirements

B. Clean and disinfect all site water systems connected to the domestic water systems in accordance with AWWA Standard C651 and as required by the local Building and Health Department Codes, and EPA.
1. Clean and disinfect industrial water system in addition to the domestic water system.
2. Disinfect existing piping systems as required to provide continuous disinfection upstream to existing valves. At Contractors option, valves may be provided to isolate the existing piping system from the new piping system.

C. Domestic water sterilization shall be performed by a licensed “qualified applicator” as required by CAL-EPA Pesticide Enforcement Branch for disinfecting and sterilizing drinking water.

D. Disinfecting Agent: Chlorine product that is a registered product with Cal-EPA for use in California potable water lines, such as Bacticide, CAL-EPA Registration No. 37982-20001.

E. Contractor to provide a 1" service valve connected to the system at a point within 2'-0" of its junction with the water supply line. After sterilization is complete Contractor to provide cap at valve.

F. Sterilization Procedure to be as follows:
   1. Flush pipe system by opening all outlets and letting water flow through the system until clear water flows from all outlets.
   2. Inject disinfecting agent to provide a minimum chlorine residual concentration of at least 50 parts per million (ppm) of free chlorine at each outlet.
   3. Provide sign at all outlets which reads "Water Sterilization in Progress – Do not operate". Remove signs at conclusion of test.
   4. Close all outlets and valves, including valve connecting to water supply line and 1" service valve. Retain treated water in pipe for a minimum of twenty-four hours. Should chlorine residual at pipe extremities be less than 50 PPM at this time, pipe shall be re-chlorinated. As an option, the water systems may be filled with a water-chlorine solution containing a minimum of 200 PPM of chlorine and allowed to stand for three hours.
   5. After chlorination, flush lines of chlorinated water and refill from domestic supply. Continue flushing until residual chlorine is less than or equal to 0.2 ppm, or a residual the same as that of the test water.

G. Chemical and bacteriological tests shall be conducted by a state-certified laboratory and approved by the local authorities having jurisdiction.

H. Submit written report to Health Department as required by State Regulations. Provide a copy of report to Architect prior to completion of project.

I. The costs of sterilization and laboratory testing shall be paid for by the contractor.

3.10 CLEANING

A. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

END OF SECTION 33 00 00

SECTION 33 40 00 – SITE DRAINAGE

PART 1 - GENERAL

1.1 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33, Trenching and Backfilling.

B. Section 32 12 00, Asphalt Concrete Paving.

C. Section 32 16 00, Site Concrete

1.3 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner’s testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner’s testing lab representatives nor the testing by the Owner’s testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.

D. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.

1.4 SUBMITTALS

A. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.5 WARRANTY

A. Refer to General Conditions.

1.6 REFERENCES AND STANDARDS

A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.

C. ANSI/ASTM D1557-02 - 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.

D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).

E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

F. CALTRANS Standard Specifications.

G. CAL-OSHA, Title 8, Section 1590 (e).

H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

I. California Plumbing Code current edition.

1.7 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.8 PROJECT CONDITIONS

A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.

1.9 EXISTING SITE 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.

1.10 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, the Contractor shall be solely and completely responsible for working conditions at the job site, 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. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

D. Provide shoring, sheeting, sheet piles and/or bracing to prevent caving, erosion or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to provide pumps and all equipment necessary to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. 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.

H. Trees: Carefully protect existing trees that are to remain.

1.11 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.12 TESTING

A. General: Refer to Quality Requirements.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and backcharged to Contractor.

1.13 RECORD DRAWINGS

A. Keep a daily record of all pipe placed in ground, verified by Project Inspector.

B. Upon completion of this Contract, furnish one tracing showing all outside utility lines, piping, etc., installed under this Contract. Locate and dimension all work with reference to permanent landmarks.

C. All symbols and designations used in preparing "RECORD" drawings shall match those used in Contract drawings.

D. Properly identify all stubs for future connections, as to location and use, by setting of concrete marker at finished grade in the manner suitable to Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe: Use one of the following, unless noted on the Drawings otherwise.
   1. Polyvinyl Chloride Pipe (PVC): SDR35 conforming to ASTM D3034 with elastomeric joints conforming to ASTM D3212. Sun damaged pipe will be rejected.
   2. High density polyethylene pipe (HDPE): The pipe shall be corrugated exterior/smooth interior pipe and water tight per ASTM D3212 with dual wall water tight gasket fittings.

B. Perforated Pipe (for subdrains): Shall be ADS N12 pipe, 2 hole, ASTM F 405, AASHTO M 252; PVC ASTM D3034 SDR-35 storm drain pipe

C. Manhole: Shall be as shown on the drawing details.

D. Drop Inlet: Shall be as shown on the drawing details.

E. Curb Inlet: Shall be as shown on the drawing details.

F. Mortar: For pipe connections to concrete drainage structures, conform to ASTM C270 type N mortar. Place within one half hour after adding water.

G. Crushed Rock: Imported washed crushed rock. Size as noted on plans.

H. Trench drain: Polycast, Polydrain or equal and as shown on drawings.

I. Area Drains: Shall be as shown on the drawing details.

J. Floor Drains: Shall be as shown on the drawing details.

K. Clean-outs: Shall be as shown on the drawing details.

L. Planter drains: Shall be as detailed on the drawing details.

M. Filter Fabric: Mirafi 140N.

PART 3 - EXECUTION

3.1 INSPECTION LAYOUT AND PREPARATION

A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point were this installation may properly commence

B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.

C. Verify that specified items may be installed in accordance with the approved design.

D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.2 INSTALLATION

A. General: Installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the drawings and as herein specified.

B. Verify invert elevations at points of connection to existing systems prior to any excavation. If invert elevations differ from that shown on drawings, notify Architect immediately.

C. Excavation and Bedding:
1. General: Trench straight and true to line and grade with bottom smooth and free of irregularities or rock points. Trench width in accordance with pipe manufacturer's recommendations and as per the drawings. Follow manufacturer's recommendations for use of each kind and type of pipe.
2. Bedding: Provide bedding as detailed on plans for the full length of the pipe. Bedding shall have a minimum thickness beneath the pipe of 4" or 1/8 the outside diameter of the pipe, which ever is greater. Provide bell holes and depressions for pipe joints only of size required to properly make joint.
3. If the trenches for the site drainage fall within areas to be lime treated, the piping shall be installed prior to any lime treatment operations.
    a. If additional piping is added to previously lime treated areas, the contractor shall backfill the trench with class 2 aggregate base and compact to 95%.

D. Laying of Pipe:
1. General: Inspect pipe prior to placing. Set aside any defective or damaged material. Do not place pipe in water nor place pipe when trenches or weather are unsuitable. Lay pipe upgrade, true to line and grade.
2. Bell and Spigot Joints: Lubricate inside of bells and outside of spigots with soap solution or as recommended by manufacture. Wedge joints tight. Bell of bell and spigot pipe to be pointed upgrade.
3. Pipe shall be bedded uniformly throughout its length.

4. Pipe elevation shall be within 0.02 feet of design elevation as shown on plans.
5. Off Site Work: All work beyond the property lines shall be done in strict conformance with the requirements of the governing agency.

E. Backfilling:
1. General: Do not start backfill operations until required testing has been accomplished.
2. Trenches and Excavations: Backfill with material as detailed on plans, filling both sides of the pipe at the same time, carefully tamping to hold pipe in place without movement. Refer to Section 31 23 33 – TRENCHING AND BACKFILLING for fill above this layer.

F. Grouting of Pipes: Grout pipes smooth and water tight at drop inlet, manholes, and curb inlets. Grout back side of hood at curb inlets all grouting shall be smooth and consistent.

G. Off Site Work: All work beyond the property lines shall be done in strict conformance with the requirements of the local agency.

H. Cutting and Patching: Remove and replace existing surface features per applicable specification section (i.e. asphaltic concrete or concrete paving) where pipe is installed in areas of existing improvements.

3.3 TOLERANCES

A. Storm Drain structure grates
1. In landscape and lawn areas +- 0.05’.
2. In sidewalk and asphalt pavement +-0.025’.
3. In curb and gutter application +-0.0125’.

B. Cleanout Boxes and Lids
1. In landscape areas; 0.10 higher than surrounding finish grade, +-0.05’.
2. In sidewalks and asphalt pavement; Flush with surrounding finish grade, +-0.025’.

3.4 DEWATERING

A. Contractor to provide trench dewatering as necessary, no matter what the source is, at no additional cost to the owner.

B. If the previously excavated material from trenching is too wet to achieve trench backfill compaction the contractor shall make a reasonable effort to aerate and dry the material per section 31 00 00, 3.08, B

3.5 FLUSHING

A. The Contractor shall thoroughly ball and flush the storm drain system to remove all dirt and debris. Discharge water to an approved location.

3.6 CLEANING

A. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

B. Clean the dirt, rocks, and debris from all storm drain inlets, structures, and connecting pipes.

END OF SECTION 33 40 00

Appendix

ENTEK
CONSULTING GROUP, INC.
3435 American River Drive, Suite C, Sacramento, CA 95864 Phone (916) 632-6800 www.entekgroup.com

HAZARDOUS MATERIALS SURVEY
FINAL REPORT

OWNER/CLIENT

Folsom Cordova Unified School District
1965 Birkmont Drive
Rancho Cordova, CA 95670

CONTACT

Mike Hammond
Facilities Project Manager

SURVEY ADDRESS

Cordova Villa Elementary School
10359 South White Rock Road
Rancho Cordova, CA 95670

BUILDING SURVEYED

Main Building, Portable Structure 17-21, Portable Structure 11-13
Modernization Project

PREPARED BY

Jonathan Gonzalez
CAC #22-7153 and CDPH I/A# 11323
Entek Consulting Group, Inc.
3435 American River Drive, Suite C
Sacramento, CA 95864

Entek Project #25-7929

December 15, 2025

ENTEK

TABLE OF CONTENTS

Executive Summary 3

Introduction 4

Building Description 5

Asbestos Inspection and Sample Collection Protocols 5

Asbestos Bulk Sample Results 6

Asbestos Regulatory Requirements 8

Lead Sampling Results 9

Lead Regulatory Compliance 10

Fluorescent Light Tubes and Polychlorinated Biphenyls (PCBs) 11

Thermostats With Mercury Switches 12

Freon and Fluorocarbons 12

Smoke Detectors Which May Contain a Radioactive Element 12

Limitations 12

Appendices

A. Asbestos Related Documents
B. Lead Related Documents
C. Backup Documents

Executive Summary

Entek Consulting Group, Inc. (Entek) is pleased to provide Mr. Mike Hammond, Facilies Project Manager for Folsom Cordova Unified School District this hazardous materials survey report regarding the Modernization Project, which consist of the Main Building, Portable Structure 17-21, and Portable Structure 11-13 at Cordova Villa Elementary School located at 10359 South White Rock Road in Rancho Crodova, California.

The purpose of the inspection was to comply with US EPA NESHAP requirements and the Sacramento Metropolitan Air Quality Management District (SMAQMD) which has jurisdiction for this project site to determine if asbestos containing materials are present which may be impacted during an upcoming modernization project. It is Entek's understanding that the Main Building is expected to be demolished and the portable structures are planned for relocation and/or renovations.

The United States Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants (US EPA NESHAP), 40 CFR Part 61 - Nov. 20, 1990, requires an owner or operator of a demolition or renovation project to thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos-containing materials (ACM) prior to the commencement of that project.

The attached drawing show approximate sample locations and also identify those bulk sample materials analyzed and found to contain asbestos greater than 1% with a (+) after the sample number. Materials analyzed and found to contain less than 1% asbestos or reported as none detected have a (-) after each sample number.

Materials are classified in the tables of this report as regulated asbestos containing material (RACM), Category I (CAT-I) or Category II (CAT-II) ACM, or asbestos containing construction material (ACCM), which included collecting multiple samples of some materials. Contractors and other individuals who view the sample locations and associated results indicated with either a (-) or a (+) on the drawing to make determinations take the risk of misidentifying a material and may arrive at determinations which are in direct conflict with the written findings of this report. This use of the drawing and the information provided on it relating to individual sample results in determining if a material does or does not contain asbestos is not recommended.

This is a summary of the report. The report must be read in its entirety, and the reader must review all the detailed information provided in the body of the report prior to making any interpretations, or conclusions pertaining to the information. Any conclusions made by the reader about the information provided in the body of this report which are contradictory or not included in this report are the responsibility of the reader.

Asbestos

On November 24, 2025 Entek conducted a survey specific to areas designated by Mr. Mike Hammond, Facilities Project Manager with Folsom Cordova Unified School District..

The results of testing for asbestos during this survey indicate asbestos is present in the following materials:

- Exterior Stucco – <1% Chrysotile confirmed by 400-point count analysis– Throughout exterior of Main Building
- Skim Coat Wall/Ceiling Texture – 2% Chrysotile – Exterior Girls Restroom Custodial Closet & Custodial Closet/Electrical Room (adjacent to front office) at Main Building
- Drywall & Joint Compound (associated with skim coat) – 2% Chrysotile (Joint Compound) - Exterior Girls Restroom Custodial Closet & Custodial Closet/Electrical Room (adjacent to front office) at Main Building

No other suspect material sampled were determined to contain asbestos. Specifics pertaining to individual materials can be found in later sections of this report.

Lead

Entek investigated existing paints, applied coatings, and glazed ceramic tiles in an effort to determine if lead was present in these materials. The lead jacket found on the roof system of the Main Building was determined to contain more than 5,000 parts per million (ppm) lead and is classified as lead-based paint (LBP). If more than 100 square feet of these paints or coatings are impacted by a “trigger task”, prior notification to Cal/OSHA will be required.

The white paint on drywall wall/ceiling systems found within the Main Building was determined to contain lead in amounts less than 5,000 ppm and is classified as lead containing paint (LCP). Any work designated by California Occupational Safety Health Administration (Cal/OSHA) as a “trigger task” which will impact these paints, coatings, or materials must be done by properly trained personnel, in compliance with all lead related Cal/OSHA regulations and requirements.

All other paints included in this survey were determined to contain lead below the laboratory limit of 100 parts per million (ppm).

Other Hazardous Materials

Entek did not specifically inspect for mercury containing fluorescent light tubes or light ballast which may contain polychlorinated biphenyls (PCBs), thermostats which may contain mercury switches, equipment or systems which may contain Freon or other fluorocarbons, or smoke detectors which may contain a radioactive element. However, information pertaining to these materials is included in this report for your use and reference, since these light systems are present on the project.

Introduction

This report presents results of a hazardous materials survey performed by Entek which included specific interior and exterior areas of the Main Building, Portable Structure (11-13), and Portable Structure (17-23) at Cordova Villa Elementary School located at 10359 South White Rock Road in Rancho Cordova, California. Anticipated work include, but are not limited to: full demolition of the Main Building, partial renovation or reloction of the

portabl structures. These areas were designated by Mr. Mike Hammond, Facilitlies Project Manager with Folsom Cordova Unified School District (FCUSD).

Fluorescent lights were observed at this project site; therefore, this report also includes references to regulations pertaining to handling practices and waste disposal of PCB light ballasts and mercury containing light tubes and thermostats which may be impacted during this project.

The inspection was conducted by Jonathan Gonzalez and Karl Suarez on November 24, 2025. Mr. Gonzalez and Mr. Suarez are both Cal/OSHA Certified Asbestos Consultants (CAC) and State of California Department of Public Health (CDPH) certified Lead Inspector/Assessors.

Building Description

The Main Building is located in the east area of the school campus. The Main Building is a single-story, wood framed structure on a concrete slab foundation. The structure is use for administration office spaces and classrooms. The interior building materials consist of carpet sheet flooring, laminated flooring, vinyl sheet flooring, terrazzo flooring, vinyl base cove with mastic, tagboard wall systems, drywall wall systems, Skim coat testure, orange peel texture, FRP paneling with mastic, 12 x 12 acoustical ceiling tiles, and 2’ x 4’ acoustical drop-inceiling panels. The above ceiling space consist of fiberglass insulation around piping and ducting, batt fiberglass insulation, and HVAC seam mastics. The exterior and roofing materials consisted of exterior stucco, concrete pillars, wood siding, window putty, roof shingles, singly-ply memberane roofing, and various HVAC mastics,

Portable Structure (17-23) and Protable Structure (11-13) were found to be similar in construction. These structures are single-story, metal and wood framed structures on a concrete slab foundation. Interior finishes include carpet flooring, laminated flooring, vinyl sheet flooring, tagboard wall systems, and acoustical drop-in ceiling panels. The materials found within the above ceiling spaces included batt fiberglass insulation and uninsulated pipes. The exterior and roofing materials consisted of wood siding, and various mastics.

Asbestos Inspection and Sample Collection Protocols

Entek included all specific designated interior and exterior materials that are expected to be impacted by the upcoming Modernization Project at Cordova Villa Elementary School.

Entek did not use any demolition methods to look within enclosed wall or ceiling cavities during this investigation. Entek did include all suspect materials observed in, on, or associated with the areas included in this report.

Bulk samples were collected of various materials suspected to contain asbestos by utilizing a power drill and coring tube, cutting the materials with a razor knife, or use of other appropriate hand tools.

Surfacing materials were collected in a statistically random manner representative of the associated homogenous area as required in 40 CFR Part 763, Asbestos-Containing Materials in Schools; Final Rule and Notice, published October 30, 1987 and the Sacramento Metropolitan Air Quality Management District (SMAQMD) Compliance

Assistance Advisory published in June 2010.

Miscellaneous materials were collected from each homogenous area in a manner sufficient to determine whether the material is or is not ACM as required in 40 CFR Part 763, Asbestos-Containing Materials in Schools; Final Rule and Notice, published October 30, 1987.

Approximate locations of all samples collected during this inspection are indicated on the "Bulk Asbestos Material Analysis Request Form for Entek", which served as the chain of custody for the samples, and on the building diagram attached to this report.

Asbestos Bulk Sample Results

There were several materials observed which are considered "suspect" under US EPA guidelines. Under current US EPA guidelines for conducting building inspections for ACM, all "suspect" materials must be assumed to contain asbestos until otherwise determined by laboratory testing.

The samples of materials suspected of containing asbestos were submitted to Eurofins EMLab P&K Laboratory, which is a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory to complete this analysis. These samples were subsequently analyzed by polarized light microscopy (PLM) with dispersion staining by the EPA 600R/R-93/116 method.

The US EPA NESHAP and SMAQMD uses the terms Regulated Asbestos Containing Material (RACM), Category I, and Category II when identifying materials which contain asbestos in amounts greater than 1%. Cal/OSHA uses the term ACCM which indicates a manufactured construction material contains greater than 0.1% asbestos by weight by the PLM method. This definition can be found in Title 8, 1529.

All samples found to contain <1% asbestos by PLM analysis which are not identified as containing >1% asbestos, classified as RACM, CAT-I, or CAT-II materials in the following results tables were additionally analyzed using the 400 point count (PC) method with analysis by PLM. This additional analysis is required by NESHAP and enforced by SMAQMD. The PC method analysis results were used only to verify a material did not contain >1% asbestos as a single layer material, or as a composite result which is provided for materials such as sheet rock/drywall and joint compound used for wall/ceiling systems. A result reported as none detected or "trace" by the PC method only verified the initial PLM result of <1% and shall not be used to determine the identified material does not contain asbestos.

Neither OSHA or Cal/OSHA allow for composite sampling of wall system materials, and neither address the use of the PC method to confirm a material identified as containing <1% asbestos by the PLM method either contains <1% asbestos or is non-detected for asbestos. As a result, reporting of the asbestos content related to a composited material such as sheet rock/drywall and joint compound does not apply to determining if a material is or is not an ACM by OSHA or an ACCM by Cal/OSHA.

A total of 131 bulk samples were collected of all "suspect" materials that were observed during this investigation. Some of those samples contained multiple layers which were

individually analyzed to determine their asbestos content. Analysis of all samples collected was by PLM with dispersion staining. Results of the analysis are listed in the following table:

Suspect Materials Found to Contain Asbestos Cordova Villa Elementay School – Main Building					
Sample ID#'s	**Suspect Material**	**Asbestos Content/Type (%) by PLM**	**Location**	**NESHAP - Cal/OSHA Classification**	**Total Estimated Quantity**
09A-G	Exterior Stucco	<1% Chrysotile (confirmed by 400-point count analysis)	Throughout exterior of Main Building	*ACCM, per Cal/OSHA*	5,000 Sq. Ft.
15A-C	Skim Coat Wall/Ceiling Texture	2% Chrysotile	Custodial Closet within Exterior Girls Restroom Custodial Closet and Electrical Room(Adjacent to front reception)	ACM , per Cal/OSHA RACM. Per NESHAP	300 Sq. Ft.
16A-B*, 39A-B*	Drywall and Joint Compound (Aassociated with Skim Coat)	(None Detected) Drywall (2% Chrysotile) Joint Compound	Custodial Closet within Exterior Girls Restrroom Custodial Closet and Electrical Room(Adjacent to front reception)	ACM , per Cal/OSHA RACM. Per NESHAP	300 Sq. Ft.

**Composite sample was not recommended for a 400-point count analysis since the skim coat texture for these wall systems contain asbestos greater than 1%.*

NOTE: Any CAT-I or CAT-II materials identified in the previous tables which will be subjected to mechanical removal, must be considered RACM for the purposes of notification to SMAQMD and classification of waste. Removal of any CAT-I or CAT-II materials prior to demolition of a building is dependent upon how the materials will be impacted and if the impact will cause the materials to become friable. If any remaining CAT-I or CAT-II materials will become friable they must be removed prior to the initiation of demolition.

NOTE: Cal/OSHA regulates all materials containing greater than 0.1% asbestos. As a result, impact to materials identified as ACCM and ACM must be performed by properly asbestos trained personnel utilizing appropriate personal protection, work practices, as well as, properly constructed and demarcated work areas or containments, in accordance with Cal/OSHA asbestos regulations.

All other suspect building materials sampled were determine to not contain asbestos. Specifics pertaining to these individual materials can be found in Appendix A.

US EPA AHERA uses three terms when determining the classification of a material for the purpose of sampling. These terms include miscellaneous, surfacing, and thermal system insulation (TSI).

Miscellaneous materials are building materials on structural components, structural members or fixtures, such as floor and ceiling tiles, and do not include surfacing material or TSI.

Surfacing materials are materials that are sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceiling and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

TSI is material applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain, water condensation, or for other purposes.

The information provided in this report is for use by the Owner in determining where asbestos containing materials are located, and whether or not any future work may impact those materials. The information is also provided for use by any contractor who may perform work in areas impacting the materials listed in this report, and for use as appropriate by asbestos abatement contractors to provide costs related to work impacting ACM.

Any building materials which are considered “suspect” for containing asbestos which have not been identified in this report must be assumed to contain asbestos in amounts >1% until properly investigated and/or tested.

Materials commonly excluded from being suspected for containing asbestos include, but are not limited to: unwrapped pink and yellow fiberglass insulating materials or products, foam insulation, wood, metal, plastic, or glass. All other types of building materials or coatings on the materials listed above are commonly listed as “suspect” and must be tested prior to impact by a Contractor. Work impacting these untested or newly discovered materials must cease until an investigation can be completed.

Asbestos Regulatory Requirements

US EPA

The property included in this survey report is located in Sacramento County. Sacramento Metropolitan Air Quality Management District (SMAQMD) has been given authority for enforcement of the NESHAP regulations by means of their own rules (Rule 902 Asbestos).

A demolition is the wrecking, taking out, or burning of any load supporting structural member. A renovation is everything else. A 10-day written notification to the US EPA Region IX, CARB or local AQMD is required prior to the performance of any demolition project regardless of asbestos being present or not. This notification would also apply to any renovation project which involves the wrecking, taking out, or burning of any load bearing structural member during a renovation as well.

There is a sufficient amount of ACM present to require a 10 day notification to the SMAQMD to be submitted prior to starting work which will impact materials identified as

RACM or CAT-I and CAT-II materials if they are made friable. If more than 160 square feet, 260 linear feet or 35 cubic feet of RACM is planned for removal on the project, formal written notification to US EPA Region IX, CARB or local AQMD is required.

Cal/OSHA

Disturbance of any ACM or ACCM could generate airborne asbestos fibers and would be regulated by Cal/OSHA. Cal/OSHA worker health and safety regulations apply during any disturbance of ACM or ACCM by a person while in the employ of another. This is true regardless of friability or quantity disturbed. Since it has been estimated more than 100 square feet of ACCM does exist and will be impacted during the upcoming project, a licensed asbestos contractor,registered with Cal/OSHA is required to perform the asbestos related removal work. Entek recommends a licensed asbestos contractor be used to remove ACCM even if less than 100 square feet of ACCM is being disturbed.

For compliance with Title 8, Section 341.9, the asbestos contractor must send written notice at least one day (24 hours) prior to start of any work which will impact any amount of asbestos to the local office for the State of California, Department of Occupational Safety and Health, and perform all work in accordance with Cal/OSHA requirements.

Lead Sampling Results

Eight bulk samples of the painted surfaces expected to be impacted in the upcoming Modernization Project were collected and submitted to MicroTest Laboratories, Inc. located in Rancho Cordova, California. The bulk sample (paint chip) was analyzed utilizing the NIOSH 7082 method (including the EPA 7000B and EPA 7420 methods) utilizing flame atomic absorption spectroscopy. MicroTest is accredited by the Environmental Laboratory Accreditation Program (ELAP) to perform the analysis. Results of the analysis are listed in the following table and further details are in Appendix B.

Paints/Coatings/ Materials Determined to be Lead Based Paint (LBP) Cordova Villa Elementay School – Main Building		
Paint/Coating Color or Material	**Lead Content**	**Component/Location**
Lead Jacket	925,067 ppm	Exhaust Pipe / West of Main Building Roof System

LBP - Materials/coatings/paints meeting the definition of lead-based paint as defined by the CDPH and the US EPA, currently defined as containing lead in concentrations equal to or greater than 1.0 mg/cm2, 5,000 ppm, or 0.5% by weight.

Paints/Coatings/ Materials Determined to be Lead Containing Paint (LCP) Cordova Villa Elementay School – Main Building		
Paint/Coating Color or Material	**Lead Content**	**Component/Location**
White Paint	838.99 ppm	Drywall Wall/Ceiling / Throughout Interior of Main Building

LCP - Materials/coatings/paints which contain measurable amounts of lead. The disturbance of these materials/coatings/paints is regulated by Cal/OSHA.

Paints Determined NOT TO Contain Lead Cordova Villa Elementay School	
Paint/Coating Color or Material	**Building Component**
Blue Paint	Metal Roof Cap / Throughout Project Scope Area
Baby Blue Paint	Interior Drywall / Throughout Project Scope Area
Tan Paint	Wood Siding / Throughout Project Scope Area
Brown Paint	Exterior Wood Support / Throughout Project Scope Area
Yellow Paint	Concrete Pavement / Throughout Project Scope Area
Red Paint	Concrete Pavement / Throughout Project Scope Area

Paints determined “NOT TO” contain lead for the purposes of this report are those samples which when analyzed did not indicate lead to be present at or above the limit of detection for the analysis method used. This limit of detection was 100 parts per million (ppm). As a result, any paints shown “NOT TO” contain lead will not require any special training or work practices related to lead when impacted.

Lead Regulatory Compliance

Any upcoming project which may result in the disturbance of lead containing products or surfaces but is not intended to remediate a lead hazard or specifically designed to remove LBP to reduce or eliminate a known hazard, would be considered “lead related construction work”.

Lead related construction work does not fit the classification of a “lead abatement project” under CDPH Title 17 regulations. “Abatement” is defined in Title 17, Division 1, Chapter 8, Article 1 as “any set of measures designed to reduce or eliminate lead hazards or LBP for public and residential buildings but does not include containment or cleaning.” A lead hazard is defined in Title 17, Division 1, Chapter 8, Article 1 as “deteriorated LBP, lead contaminated dust, lead contaminated soil, disturbing LBP or presumed LBP without containment, or any other nuisance which may result in persistent and quantifiable lead exposure.”

Lead related construction work means any “construction, alteration, painting, demolition, salvage, renovation, repair, or maintenance of any residential or public building, including

preparation and cleanup, that, by using or disturbing lead-containing material or soil, may result in significant exposure of adults or children to lead". (Title 17, California Code of Regulations, Division 1, Chapter 8, Article 1).

Currently, Cal/OSHA has not established a definition for LBP, nor have they established minimum concentrations where their regulations do not apply. Cal/OSHA regulates all construction activities involving materials containing lead, including LBP. These regulations are found in CCR, Title 8 Section 1532.1 (§1532.1) Lead in Construction.

Cal/OSHA has not established a concentration of lead in a product where their regulations do not apply, therefore, any disturbance to products containing lead come under the jurisdiction of Cal/OSHA and their regulations. Disturbance of paints/coatings or materials determined to be LBP may trigger a pre-work notification to Cal/OSHA if "trigger tasks" disturb 100 square feet or more of those paints/coatings or materials. Trigger tasks are described in Title 8 CCR 1532.1.

Fluorescent Light Tubes and Polychlorinated Biphenyls (PCBs)

Fluorescent light tubes which contain mercury are considered a universal waste and must be packaged and recycled appropriately if they are removed from a building and not used again. The regulation, called the Universal Waste Rule, are in the California Code of Regulations (CCR), Title 22, Division 4.5, Chapter 23.

Fluorescent light tubes are the bulb or tube portion of an electric lighting device and are commonly referred to as "lamps". Examples of other common electric lamps considered to be universal wastes include, but are not limited to, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps. Any lamp which is not spent and has been designated to be reused is not classified as a waste and does not meet the requirements of a hazardous waste or a universal waste.

Spent lamps typically contain concentrations of mercury exceeding the established Total Threshold Limit Concentration (TTLC) and/or the Soluble Threshold Limit Concentration (STLC) values. Therefore, these lamps must be sent to an authorized recycle facility or to a universal waste consolidator for shipment to an authorized recycling facility.

At a minimum, if removed lamps will not be reused they must be packaged in boxes/ packages/containers which are structurally sound, adequate to prevent breakage, and compatible with the content of the lamps. These packages must remain closed and be free of damage which could cause leakage under reasonably foreseeable conditions. Each container must be labeled or marked clearly with one of the following phrases: "Universal Waste Lamp(s)," or "Waste Lamp(s)," or "Used Lamp(s)." Entek recommends shipping any lamp not designated for reuse to a universal waste recycling facility once they have been packaged.

PCB containing light ballasts are to be considered a hazardous waste, and must be properly manifested for transport to a hazardous waste facility. Any contractor who may perform PCB related work (inspection, removal, clean-up) must be trained and qualified to do so. All workers must also follow current OSHA regulations including 29 CFR 1910.120 and 8 CCR 5192, as well as, other applicable federal, state, and local laws, and regulations. While light ballasts marked "No PCB" are not considered a hazardous waste,

they are considered a universal waste. As a result, removal, packaging, and disposal/recycling of these types of ballasts must be conducted in accordance with current regulations of Title 22.

Thermostats with Mercury Switches

It is possible existing thermostats may utilize switches containing mercury. The mercury in these switches would be considered a hazardous waste if removed and disposed. Any work requiring removal of thermostats containing mercury switches, must include having the switches inspected for the presence of mercury, and subsequently following all requirements for packaging and disposal of any switch found to contain mercury.

Freon and Fluorocarbons

Freon and other fluorocarbon products associated with HVAC systems, refrigerators, etc. may be present in or on the exterior of the buildings included in this investigation. Prior to demolition of a structure or removal of existing HVAC systems, refrigerators, or any other type of equipment which typically uses these types of coolant products shall have the coolant materials investigated prior to their demolition and removed from the mechanical systems and recycled in accordance with Cal/EPA requirements.

Smoke Detectors Which May Contain a Radioactive Element

It is possible existing smoke detectors may contain a radioactive element. These types of detectors are easily identified by reviewing the label which is usually found on the back of the detector. Older units may display the international radiation symbol (three bladed propeller) and the radioactive content. Newer units state the radioactive content and their Nuclear Regulatory Agency (NRC) license number.

Any work requiring the removal of smoke detectors with a radioactive element must include contacting the manufacturer of the smoke detector to determine their return policies. The California Department of Toxic Substance Control (DTSC) has stated that it is a condition of the manufacturers NRC license they must accept returned units for disposal.

Limitations

Entek inspected only the specific designated areas of the Main Building, Portable Sturcture (17-23), and Portable Structure (11-13) at Cordova Villa Elementary School as identified by Mr. Mike Hammond, Facilities Projct Manager with FCUSD for the upcoming Modernization Project. This survey does not include all other areas within Cordova Villa Elementary School or other exterior areas. Therefore, the information provided in this inspection report may not be used to extend the inspection results to areas not included in this report without additional review and sampling as necessary.

Entek did not perform any destructive sampling to look into ceiling and wall cavities. As a result, it may be possible for materials to be hidden in these areas which are not included in this report. Entek also did not employ any destructive measures on floors of interior spaces or exterior areas covered with asphalt, concrete, or dirt.

If any new materials not listed as having been sampled, or listed as assumed for containing asbestos in this report are discovered, the new material must be assumed to contain asbestos until properly inspected and tested for asbestos content.

Entek's policy is to retain a full copy of these written documents for three years once the file is closed. At the end of the three year period the written files will be destroyed without further notice. It is suggested copies of the file(s) are maintained as per your policy.

Thank you for choosing Entek for your environmental needs. Please call me at (916) 632-6800 if you have any questions regarding this report.

Prepared by:



Jonathan Gonzalez, CSP, CAC, I/A
IH Project Manager

Reviewed by:



Blake Howes, CAC, I/A
Vice President

Appendices

A. Asbestos Related Documents
B. Lead Related Documents
C. Backup Documents

APPENDIX A

ASBESTOS RELATED DOCUMENTS

- Bulk Request Analysis Results from EMLab P&K
- Bulk Analysis Request Form for Entek
- SMAQMD Asbestos Survey Form
- SMAQMD Reno-Demo Form
- Sample Location Drawing

eurofins | Built Environment Testing

ENTEK CONSULTING GROUP, INC.

Report for:

Jonathan Gonzalez
Entek Consulting Group
3435 American River Drive
Suite C
Sacramento, CA 95864

Regarding:
Eurofins Built Environment Testing West, LLC
Project: 25-7929; Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 9567
EML ID: 4326286

Approved by:



Approved Signatory
Amin Suliman

Dates of Analysis:
Asbestos PLM: 12-04-2025

Service SOPs: Asbestos PLM (EPA 40CFR App E to Sub E of Part 763 & EPA METHOD 600/R-93-116, SOP EB-AS-S-1267)
NVLAP Lab Code 200728-0

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. The results relate only to the samples as received and tested. The results include an inherent uncertainty of measurement associated with estimating percentages by polarized light microscopy. Measurement uncertainty data for sample results with >1% asbestos concentration can be provided when requested.

Eurofins Built Environment Testing West, LLC ("the Company"), a member of the Eurofins Built Environment Testing group of companies, shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

Eurofins Built Environment Testing West, LLC
111 Anza Boulevard, Suite 122, Burlingame, CA 94010
(833) 465-5857 www.eurofinsus.com/Built

Client: Entek Consulting Group
C/O: Jonathan Gonzalez
Re: 25-7929; Cordova Villa Elementary School
10359 S White Rock Road, Rancho Cordova, CA 9567

Date of Sampling: 11-24-2025
Date of Receipt: 12-01-2025
Date of Report: 12-04-2025

ASBESTOS PLM REPORT

Total Samples Submitted:	131
Total Samples Analyzed:	131
Total Samples with Layer Asbestos Content > 1%:	5

Location: ECG-25-7929-01A, Single Ply Roofing Membrane - Main Office Building Roof, West on Roof
Lab ID-Version‡: 21663284-1

Sample Layers	Asbestos Content
White Roofing Material (Membrane)	ND
White Tape	ND
White Drywall	ND
Brown Wood	ND
Composite Non-Asbestos Content:	10% Cellulose 5% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-01B, Single Ply Roofing Membrane - Main Office Building Roof, North on Roof
Lab ID-Version‡: 21663285-1

Sample Layers	Asbestos Content
White Roofing Material (Membrane)	ND
White Tape	ND
White Drywall	ND
Brown Wood	ND
Composite Non-Asbestos Content:	10% Cellulose 5% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-01D, Single Ply Roofing Membrane - Main Office Building Roof, East Parapet Wall on Roof
Lab ID-Version‡: 21663286-1

Sample Layers	Asbestos Content
White Roofing Material (Membrane)	ND
Yellow Adhesive	ND
Brown Wood	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

The test report shall not be reproduced except in full, without written approval of the laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. The Company reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified.

All components not quantified as asbestos content and non-asbestos content are considered to be non-fibrous matrix components. Matrix components may include, but are not limited to, gypsum, paint, silicate minerals, vinyl, binder, calcium carbonate, tar, and foam.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. ND means no fibers were detected. When detected, the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.
‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

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111 Anza Boulevard, Suite 122, Burlingame, CA 94010
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Client: Entek Consulting Group
C/O: Jonathan Gonzalez
Re: 25-7929; Cordova Villa Elementary School
10359 S White Rock Road, Rancho Cordova, CA 9567

Date of Sampling: 11-24-2025
Date of Receipt: 12-01-2025
Date of Report: 12-04-2025

ASBESTOS PLM REPORT

Location: ECG-25-7929-02A, White Pipe Penetration Mastic - Main Office Building Roof, Southeast on Roof

Lab ID-Version‡: 21663287-1

Sample Layers	Asbestos Content
White Mastic	ND
Composite Non-Asbestos Content:	3% Cellulose
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-02B, White Pipe Penetration Mastic - Main Office Building Roof, South on Roof

Lab ID-Version‡: 21663288-1

Sample Layers	Asbestos Content
White Mastic	ND
Composite Non-Asbestos Content:	3% Cellulose
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-03A, White Insulation on HVAC Conduit - Main Office Building, Southeast on Roof

Lab ID-Version‡: 21663289-1

Sample Layers	Asbestos Content
White Insulation	ND
Composite Non-Asbestos Content:	80% Glass Fibers
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-03B, White Insulation on HVAC Conduit - Main Office Building, Southwest on Roof

Lab ID-Version‡: 21663290-1

Sample Layers	Asbestos Content
White Insulation	ND
Composite Non-Asbestos Content:	80% Glass Fibers
Sample Composite Homogeneity:	Good

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Client: Entek Consulting Group
C/O: Jonathan Gonzalez
Re: 25-7929; Cordova Villa Elementary School
10359 S White Rock Road, Rancho Cordova, CA 9567

Date of Sampling: 11-24-2025
Date of Receipt: 12-01-2025
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ASBESTOS PLM REPORT

Location: ECG-25-7929-03C, White Insulation on HVAC Conduit - Main Office Building, South on Rood

Lab ID-Version‡: 21663291-1

Sample Layers	Asbestos Content
White Insulation	ND
Composite Non-Asbestos Content:	80% Glass Fibers
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-04A, Red Brick with Gray Mortar - Main Office Building, Southeast Exterior

Lab ID-Version‡: 21663292-1

Sample Layers	Asbestos Content
Red Brick	ND
Gray Mortar	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-04C, Red Brick with Gray Mortar - Main Office Building, West Exterior

Lab ID-Version‡: 21663293-1

Sample Layers	Asbestos Content
Red Brick	ND
Gray Mortar	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-05A, Concrete Pillar - Main Office Building, South Exterior

Lab ID-Version‡: 21663294-1

Sample Layers	Asbestos Content
Gray Concrete	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-05B, Concrete Pillar - Main Office Building, North Exterior Lab ID-Version‡: 21663295-1

Sample Layers	Asbestos Content
Gray Concrete	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-06A, Brown Asphaltic Roof Shingle - Main Office Building, North Exterior Lab ID-Version‡: 21663296-1

Sample Layers	Asbestos Content
Brown/Black Roofing Shingle	ND
Black Roofing Tar	ND
Black Roofing Shingle	ND
Black Roofing Tar	ND
Composite Non-Asbestos Content:	40% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-06B, Brown Asphaltic Roof Shingle - Main Office Building, Northeast Exterior Lab ID-Version‡: 21663297-1

Sample Layers	Asbestos Content
Brown/Black Roofing Shingle	ND
Black Roofing Tar	ND
Black Roofing Shingle	ND
Black Roofing Tar	ND
Composite Non-Asbestos Content:	40% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-07A, White Window Putty - Main Office Building, Northeast Exterior Lab ID-Version‡: 21663298-1

Sample Layers	Asbestos Content
White Window Putty	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-07B, White Window Putty - Main Office Building, Northeast Exterior

Lab ID-Version‡: 21663299-1

Sample Layers	Asbestos Content
White Window Putty	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-08A, Concrete Foundation - Main Office Building, Southeast Exterior

Lab ID-Version‡: 21663300-1

Sample Layers	Asbestos Content
Gray Concrete with Paint	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-08B, Concrete Foundation - Main Office Building, Southeast Exterior

Lab ID-Version‡: 21663301-1

Sample Layers	Asbestos Content
Gray Concrete with Paint	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-09A, Exterior Stucco - Main Office Buiding, Southeast Exterior

Lab ID-Version‡: 21663302-1

Sample Layers	Asbestos Content
Tan Stucco	ND
Red-Brown Stucco	ND
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-09B, Exterior Stucco - Main Office Buiding, Center East Exterior

Lab ID-Version‡: 21663303-1

Sample Layers	Asbestos Content
Tan Stucco	ND
Red-Brown Stucco	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-09C, Exterior Stucco - Main Office Buiding, North East Exterior

Lab ID-Version‡: 21663304-1

Sample Layers	Asbestos Content
Tan Stucco	ND
Red-Brown Stucco	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-09D, Exterior Stucco - Main Office Buiding, West Exterior

Lab ID-Version‡: 21663305-1

Sample Layers	Asbestos Content
White Stucco with Paint	< 1% Chrysotile
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-09E, Exterior Stucco - Main Office Buiding, West Exterior

Lab ID-Version‡: 21663306-1

Sample Layers	Asbestos Content
White Stucco with Paint	< 1% Chrysotile
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-09F, Exterior Stucco - Main Office Buiding, West Exterior Lab ID-Version‡: 21663307-1

Sample Layers	Asbestos Content
White Stucco with Paint	< 1% Chrysotile
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-09G, Exterior Stucco - Main Office Buiding, West Exterior Lab ID-Version‡: 21663308-1

Sample Layers	Asbestos Content
White Stucco with Paint	< 1% Chrysotile
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-10A, Caulking in Between Concrete Seams - Main Office Building, East Exterior Lab ID-Version‡: 21663309-1

Sample Layers	Asbestos Content
Gray Caulk	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-10B, Caulking in Between Concrete Seams - Main Office Building, East Exterior Lab ID-Version‡: 21663310-1

Sample Layers	Asbestos Content
Gray Caulk	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-11A, Rocky Pavement - Main Office Building, West Exterior Lab ID-Version‡: 21663311-1

Sample Layers	Asbestos Content
Gray Non-Fibrous Material (Rocky Pavement)	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-11B, Rocky Pavement - Main Office Building, West Exterior Lab ID-Version‡: 21663312-1

Sample Layers	Asbestos Content
Gray Non-Fibrous Material (Rocky Pavement)	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-12A, Terrazzo Flooring - Main Office Building, Exterior Boys Restroom, At Door Threshold Lab ID-Version‡: 21663313-1

Sample Layers	Asbestos Content
Beige Flooring	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-12B, Terrazzo Flooring - Main Office Building, Exterior Boys Restroom, At Door Threshold Lab ID-Version‡: 21663314-1

Sample Layers	Asbestos Content
Beige Flooring	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-12C, Terrazzo Flooring - Main Office Building, Exterior Boys Restroom, At Door Threshold Lab ID-Version‡: 21663315-1

Sample Layers	Asbestos Content
Beige Flooring	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-13A, Beige Mastic Behind Fiberglass Reinforced Paneling - Main Office Building, Exterior Girls Restroom Lab ID-Version‡: 21663316-1

Sample Layers	Asbestos Content
Beige Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-13B, Beige Mastic Behind Fiberglass Reinforced Paneling - Main Office Building, Exterior Boys Restroom Lab ID-Version‡: 21663317-1

Sample Layers	Asbestos Content
Beige Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-14A, Asphalt - Blacktop West of Main Office Building Lab ID-Version‡: 21663318-1

Sample Layers	Asbestos Content
Black Asphalt	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-14B, Asphalt - Blacktop West of Main Office Building Lab ID-Version‡: 21663319-1

Sample Layers	Asbestos Content
Black Asphalt	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-15A, Skim Coat on Drywall Wall System - Main Office Building, Exterior Girls Restroom, Janitorial Closet, North Wall Lab ID-Version‡: 21663320-1

Sample Layers	Asbestos Content
White Skim Coat	2% Chrysotile
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-15B, Skim Coat on Drywall Wall System - Main Office Building, Exterior Girls Restroom, Janitorial Closet, East Wall Lab ID-Version‡: 21663321-1

Sample Layers	Asbestos Content
White Skim Coat	2% Chrysotile
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-15C, Skim Coat on Drywall Wall System - Main Office Building, Custodial Closet, South Wall Lab ID-Version‡: 21663322-1

Sample Layers	Asbestos Content
White Drywall with Brown Paper with Paint	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Good

Comments: No compound material present.

Location: ECG-25-7929-16A, Drywall & Joint Compound - Main Office Building, Exterior Girls Restroom, Janitorial Closet, Northeast Corner Lab ID-Version‡: 21663323-1

Sample Layers	Asbestos Content
White Tape	ND
White Joint Compound	2% Chrysotile
White Drywall with Brown Paper	ND
Composite Asbestos Fibrous Content:	< 1% Asbestos
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Poor

Comments: Composite asbestos content provided is only for Drywall/Joint compound. Composite content provided for this analysis has been performed by following the NESHAP guidelines.

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ASBESTOS PLM REPORT

Location: ECG-25-7929-16B, Drywall & Joint Compound - Main Office Building, Exterior Girls Restroom, Janitorial Closet, Southeast Corner

Lab ID-Version‡: 21663324-1

Sample Layers	Asbestos Content
White Drywall	ND
Composite Non-Asbestos Content:	5% Cellulose
Sample Composite Homogeneity:	Poor

Comments: No Joint Compound present.

Location: ECG-25-7929-19A, Black Window Putty - Main Office Building, West Exterior

Lab ID-Version‡: 21663325-1

Sample Layers	Asbestos Content
Black Window Putty	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-19B, Black Window Putty - Main Office Building, West Exterior

Lab ID-Version‡: 21663326-1

Sample Layers	Asbestos Content
Black Window Putty	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-20A, Gray Penetration Mastic - Portable Buildings Exterior, Roof of Classrooms 14-17, North on Roof

Lab ID-Version‡: 21663327-1

Sample Layers	Asbestos Content
Gray Mastic	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-20B, Gray Penetration Mastic - Portable Buildings Exterior, Roof of Classrooms 14-17, Center on Roof

Lab ID-Version‡: 21663328-1

Sample Layers	Asbestos Content
Gray Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-21A, White Penetration Mastic - Portable Buildings Exterior, Roof of Classrooms 18-23, Center on Roof

Lab ID-Version‡: 21663329-1

Sample Layers	Asbestos Content
White Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-21B, White Penetration Mastic - Portable Buildings Exterior, Roof of Classrooms 18-23, Center on Roof

Lab ID-Version‡: 21663330-1

Sample Layers	Asbestos Content
White Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-22A, Black Penetration Mastic - Portable Buildings Exterior, Roof of Classrooms 14-17, South on Roof

Lab ID-Version‡: 21663331-1

Sample Layers	Asbestos Content
Black Mastic	ND
Composite Non-Asbestos Content:	3% Cellulose
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-22B, Black Penetration Mastic - Portable Buildings Exterior, Roof of Classrooms 18-23, South on Roof

Lab ID-Version‡: 21663332-1

Sample Layers	Asbestos Content
Black Mastic	ND
Composite Non-Asbestos Content:	3% Cellulose
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-23A, White Penetration Mastic - Portable Buildings Exterior, HVAC Mastic, Roof of Classrooms 18-23, North on Roof

Lab ID-Version‡: 21663333-1

Sample Layers	Asbestos Content
White Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-23B, White Penetration Mastic - Portable Buildings Exterior, HVAC Mastic, Roof of Classrooms 18-23, South on Roof

Lab ID-Version‡: 21663334-1

Sample Layers	Asbestos Content
White Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-24A, Black Over Gray Penetration Mastic - Portable Buildings Exterior, North on Restroom Roof

Lab ID-Version‡: 21663335-1

Sample Layers	Asbestos Content
Black Mastic	ND
Composite Non-Asbestos Content:	3% Cellulose
Sample Composite Homogeneity:	Good

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(833) 465-5857 www.eurofinsus.com/Built

Client: Entek Consulting Group
C/O: Jonathan Gonzalez
Re: 25-7929; Cordova Villa Elementary School
10359 S White Rock Road, Rancho Cordova, CA 9567

Date of Sampling: 11-24-2025
Date of Receipt: 12-01-2025
Date of Report: 12-04-2025

ASBESTOS PLM REPORT

Location: ECG-25-7929-24B, Black Over Gray Penetration Mastic - Portable Buildings Exterior, Center on Restroom Roof

Lab ID-Version‡: 21663336-1

Sample Layers	Asbestos Content
Black Mastic	ND
Composite Non-Asbestos Content:	3% Cellulose
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-25A, Dark Blue Carpet Sheeting with Yellow Mastic - Main Office Building, Main Adj. Room, Door Threshold

Lab ID-Version‡: 21663337-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Yellow Mastic	ND
White Leveling Compound	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-25B, Dark Blue Carpet Sheeting with Yellow Mastic - Main Office Building, Classroom 10 by Exit

Lab ID-Version‡: 21663338-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Yellow Mastic	ND
White Leveling Compound	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-25C, Dark Blue Carpet Sheeting with Yellow Mastic - Main Office Building, North Main Adj. Room, Door Threshold

Lab ID-Version‡: 21663339-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Yellow Mastic	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

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Re: 25-7929; Cordova Villa Elementary School
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Date of Sampling: 11-24-2025
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ASBESTOS PLM REPORT

Location: ECG-25-7929-26A, Light Blue Carpet Sheeting with Mastic - Main Office Building, Main Hallway, Door Threshold

Lab ID-Version‡: 21663340-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Yellow Mastic	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-26B, Light Blue Carpet Sheeting with Mastic - Main Office Building, By Receptionist Door

Lab ID-Version‡: 21663341-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Yellow Mastic	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-27A, 12" x 12" White Vinyl Floor Tile with Green Mastic - Main Office Building, Classroom 4, By Exit

Lab ID-Version‡: 21663342-1

Sample Layers	Asbestos Content
White Floor Tile	ND
Yellow Mastic	ND
Green Leveling Compound	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-27B, 12" x 12" White Vinyl Floor Tile with Green Mastic - Main Office Building, Classroom 8, By Exit

Lab ID-Version‡: 21663343-1

Sample Layers	Asbestos Content
White Floor Tile	ND
Yellow Mastic	ND
Green Leveling Compound	ND
Sample Composite Homogeneity:	Good

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Date of Receipt: 12-01-2025
Date of Report: 12-04-2025

ASBESTOS PLM REPORT

Location: ECG-25-7929-28A, 12" x 12" Green Tint Vinyl Floor Tile with Brown Mastic - Main Office Building, Library by South Entrance Lab ID-Version‡: 21663344-1

Sample Layers	Asbestos Content
Green Floor Tile	ND
Yellow Mastic	ND
Brown Leveling Compound	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-28B, 12" x 12" Green Tint Vinyl Floor Tile with Brown Mastic - Main Office Building, Printer Room by East Door Lab ID-Version‡: 21663345-1

Sample Layers	Asbestos Content
Green Floor Tile	ND
Yellow Mastic	ND
Brown Leveling Compound	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-29A, Gray Vinyl Sheet Flooring with Tan Mastic - Main Office Building, North Restroom at Door Lab ID-Version‡: 21663346-1

Sample Layers	Asbestos Content
Gray Sheet Flooring	ND
Tan Mastic	ND
Composite Non-Asbestos Content:	3% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-29B, Gray Vinyl Sheet Flooring with Tan Mastic - Main Office Building, South Restroom at Door Lab ID-Version‡: 21663347-1

Sample Layers	Asbestos Content
Gray Sheet Flooring	ND
Tan Mastic	ND
Composite Non-Asbestos Content:	3% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-30A, Green Carpet Sheeting - Main Office Building, Library, North within Room

Lab ID-Version‡: 21663348-1

Sample Layers	Asbestos Content
Green Carpet	ND
Yellow Mastic	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-30B, Green Carpet Sheeting - Main Office Building, Library, South within Room

Lab ID-Version‡: 21663349-1

Sample Layers	Asbestos Content
Green Carpet	ND
Yellow Mastic	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-31A, Wood Pattern Laminate Flooring - Main Office Building, Staff Lounge by Fridge

Lab ID-Version‡: 21663350-1

Sample Layers	Asbestos Content
Brown Flooring	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-31B, Wood Pattern Laminate Flooring - Main Office Building, Staff Lounge, By fridge

Lab ID-Version‡: 21663351-1

Sample Layers	Asbestos Content
Brown Flooring	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-32A, 2' x 2' Blue Vinyl Floor Tile with Yellow Mastic - Main Office Building, Main Entrance by Door to Hallway

Lab ID-Version‡: 21663352-1

Sample Layers	Asbestos Content
Blue Floor Tile	ND
Yellow Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-32B, 2' x 2' Blue Vinyl Floor Tile with Yellow Mastic - Main Office Building, Main Entrance by East Wall

Lab ID-Version‡: 21663353-1

Sample Layers	Asbestos Content
Blue Floor Tile	ND
Yellow Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-33A, 4" Black Cove Base with Tan Mastic - Main Office Building, Hallway

Lab ID-Version‡: 21663354-1

Sample Layers	Asbestos Content
Black Cove Base	ND
Tan Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-33B, 4" Black Cove Base with Tan Mastic - Main Office Building, By Hallway Cabinet

Lab ID-Version‡: 21663355-1

Sample Layers	Asbestos Content
Black Cove Base	ND
Tan Mastic	ND
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-34A, 4" Black Vinyl Cove Base with Tan Mastic - Main Office Building, Front Reception Desk, East Wall

Lab ID-Version‡: 21663356-1

Sample Layers	Asbestos Content
Blue Cove Base	ND
Tan Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-34B, 4" Black Vinyl Cove Base with Tan Mastic - Main Office Building, South Adj. Room, South Wall

Lab ID-Version‡: 21663357-1

Sample Layers	Asbestos Content
Blue Cove Base	ND
Tan Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-35A, Gray Wallpaper - Main Office Building Throughout, Room 6, Southeast Corner

Lab ID-Version‡: 21663358-1

Sample Layers	Asbestos Content
Gray Wallpaper	ND
Beige Adhesive	ND
White Compound	ND
Brown Fiberboard with Paint	ND
Composite Non-Asbestos Content:	40% Cellulose 10% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-35B, Gray Wallpaper - Main Office Building Throughout, South Adj. Room, Northwest Corner

Lab ID-Version‡: 21663359-1

Sample Layers	Asbestos Content
Gray Wallpaper	ND
Beige Adhesive	ND
White Compound	ND
Brown Fiberboard with Paint	ND
Composite Non-Asbestos Content:	40% Cellulose 10% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-36A, Tagboard - Main Office Building Throughout, Room 6, Southeast Corner

Lab ID-Version‡: 21663360-1

Sample Layers	Asbestos Content
Gray Wallpaper	ND
Beige Adhesive	ND
White Compound	ND
Brown Fiberboard with Paint	ND
Composite Non-Asbestos Content:	40% Cellulose 10% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-36B, Tagboard - Main Office Building Throughout, South Adj. Room, Northwest Corner

Lab ID-Version‡: 21663361-1

Sample Layers	Asbestos Content
Gray Wallpaper	ND
Beige Adhesive	ND
White Compound	ND
Brown Fiberboard with Paint	ND
Composite Non-Asbestos Content:	40% Cellulose 10% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-37A, Concrete Columns - Main Office Building, Room 8, West Column

Lab ID-Version‡: 21663362-1

Sample Layers	Asbestos Content
Gray Concrete	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-37B, Concrete Columns - Main Office Building, Room 8, East Column

Lab ID-Version‡: 21663363-1

Sample Layers	Asbestos Content
Gray Concrete	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-38A, Mastic Behind Fiberglass Reinforced Panels - Main office Building, North Restroom, West Wall

Lab ID-Version‡: 21663364-1

Sample Layers	Asbestos Content
White Fiberglass Reinforced Plastic	ND
Transparent Adhesive	ND
Brown Fiberboard with Paint	ND
Composite Non-Asbestos Content:	20% Cellulose 10% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-38B, Mastic Behind Fiberglass Reinforced Panels - Main office Building, North Restroom, West Wall

Lab ID-Version‡: 21663365-1

Sample Layers	Asbestos Content
White Fiberglass Reinforced Plastic	ND
Transparent Adhesive	ND
Brown Fiberboard with Paint	ND
Composite Non-Asbestos Content:	20% Cellulose 10% Glass Fibers
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-39A, Drywall and Joint Compound - Main Office Building, Custodial Closet, Northwest Corner

Lab ID-Version‡: 21663366-1

Sample Layers	Asbestos Content
White Joint Compound	2% Chrysotile
White Tape	ND
White Joint Compound	2% Chrysotile
White Drywall with Brown Paper	ND
Composite Asbestos Fibrous Content:	< 1% Asbestos
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Moderate

Comments: Composite asbestos content provided is only for Drywall/Joint compound. Composite content provided for this analysis has been performed by following the NESHAP guidelines.

Location: ECG-25-7929-39B, Drywall and Joint Compound - Main Office Building, Custodial Closet, Southwest Corner

Lab ID-Version‡: 21663367-1

Sample Layers	Asbestos Content
White Joint Compound	2% Chrysotile
White Tape	ND
White Joint Compound	2% Chrysotile
White Drywall with Brown Paper	ND
Composite Asbestos Fibrous Content:	< 1% Asbestos
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Moderate

Comments: Composite asbestos content provided is only for Drywall/Joint compound. Composite content provided for this analysis has been performed by following the NESHAP guidelines.

Location: ECG-25-7929-41A, 2' x 4' Drop-In Acoustical Ceiling Tile - Main Office Building, Classroom 9, North in Classroom

Lab ID-Version‡: 21663368-1

Sample Layers	Asbestos Content
Brown Ceiling Tile with White Surface	ND
Composite Non-Asbestos Content:	70% Cellulose 20% Glass Fibers
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-41B, 2' x 4' Drop-In Acoustical Ceiling Tile - Main Office Building, Classroom 3, South in Classroom

Lab ID-Version‡: 21663369-1

Sample Layers	Asbestos Content
Brown Ceiling Tile with White Surface	ND
Composite Non-Asbestos Content:	70% Cellulose 20% Glass Fibers
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-42A, 12" x 12" Glued on Acoustical Ceiling Tiles with Mastic - Main Office Building, North Hallway Adjacent to Restroom

Lab ID-Version‡: 21663370-1

Sample Layers	Asbestos Content
Gray Ceiling Tile with White Surface	ND
Transparent Mastic	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	40% Cellulose 20% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-42B, 12" x 12" Glued on Acoustical Ceiling Tiles with Mastic - Main Office Building, South in Adj. Room

Lab ID-Version‡: 21663371-1

Sample Layers	Asbestos Content
Gray Ceiling Tile with White Surface	ND
Transparent Mastic	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	40% Cellulose 20% Glass Fibers
Sample Composite Homogeneity:	Moderate

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(833) 465-5857 www.eurofinsus.com/Built

Client: Entek Consulting Group
C/O: Jonathan Gonzalez
Re: 25-7929; Cordova Villa Elementary School
10359 S White Rock Road, Rancho Cordova, CA 9567

Date of Sampling: 11-24-2025
Date of Receipt: 12-01-2025
Date of Report: 12-04-2025

ASBESTOS PLM REPORT

Location: ECG-25-7929-43A, Heating, Ventilation, and Air Conditioning Duct Mastic - Main office Building, South in Adj. Room

Lab ID-Version‡: 21663372-1

Sample Layers	Asbestos Content
Gray Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-43B, Heating, Ventilation, and Air Conditioning Duct Mastic - Main office Building, North in Classroom 9

Lab ID-Version‡: 21663373-1

Sample Layers	Asbestos Content
Gray Mastic	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-44A, Drywall and Joint Compound - Main Office Building, South Restroom

Lab ID-Version‡: 21663374-1

Sample Layers	Asbestos Content
White Joint Compound	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose 2% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-44B, Drywall and Joint Compound - Main Office Building, Printer Room

Lab ID-Version‡: 21663375-1

Sample Layers	Asbestos Content
White Joint Compound	ND
White Tape	ND
White Joint Compound	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	15% Cellulose 2% Glass Fibers
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-45A, Orange Peel Wall Texture - Main Office Building, Printer Room, West Wall Lab ID-Version‡: 21663376-1

Sample Layers	Asbestos Content
White Texture	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-45B, Orange Peel Wall Texture - Main Office Building, Printer Room, West Wall Lab ID-Version‡: 21663377-1

Sample Layers	Asbestos Content
White Texture	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-45C, Orange Peel Wall Texture - Main Office Building, Printer Room, East Wall Lab ID-Version‡: 21663378-1

Sample Layers	Asbestos Content
White Texture	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-45D, Orange Peel Wall Texture - Main Office Building, Janitorial Closet in Between Boys and Girls Restroom, Southwest Corner Lab ID-Version‡: 21663379-1

Sample Layers	Asbestos Content
White Texture	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-45E, Orange Peel Wall Texture - Main Office Building, Janitorial Closet in Between Boys and Girls Restroom, Southwest Corner Lab ID-Version‡: 21663380-1

Sample Layers	Asbestos Content
White Texture	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-46B, Remnant Black Vinyl base Cove Mastic - Main Office Building, Custodial Closet, West Wall Lab ID-Version‡: 21663381-1

Sample Layers	Asbestos Content
Brown/Black Mastic	ND
Composite Non-Asbestos Content:	2% Wollastonite
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-47A, Skim Coat Ceiling Texture - Main Office Building, South Restroom, Ceiling Lab ID-Version‡: 21663382-1

Sample Layers	Asbestos Content
White Skim Coat	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-47B, Skim Coat Ceiling Texture - Main Office Building, North Restroom, Ceiling Lab ID-Version‡: 21663383-1

Sample Layers	Asbestos Content
White Skim Coat	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-47C, Skim Coat Ceiling Texture - Main Office Building, North Restroom, Ceiling

Lab ID-Version‡: 21663384-1

Sample Layers	Asbestos Content
White Skim Coat	ND
White Drywall with Brown Paper	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-48A, Gray Vinyl Sheet Flooring with Yellow Mastic - Portable Classroom 11, East within Classroom

Lab ID-Version‡: 21663385-1

Sample Layers	Asbestos Content
Gray Sheet Flooring with Fibrous Backing	ND
Yellow Mastic	ND
Composite Non-Asbestos Content:	20% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-48B, Gray Vinyl Sheet Flooring with Yellow Mastic - Portable Classroom 11, East within Classroom

Lab ID-Version‡: 21663386-1

Sample Layers	Asbestos Content
Gray Sheet Flooring with Fibrous Backing	ND
Yellow Mastic	ND
Composite Non-Asbestos Content:	20% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-49A, Blue Carpet Sheeting with Mastic - Portable Classroom 13, North within Clasroom

Lab ID-Version‡: 21663387-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Cream Mastic	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-49B, Blue Carpet Sheeting with Mastic - Portable Classroom 12, North within Clasroom

Lab ID-Version‡: 21663388-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Cream Mastic	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-50A, 4" Gray Vinyl Cove Base with Beige Mastic - Portable Classroom 11, West within Classroom

Lab ID-Version‡: 21663389-1

Sample Layers	Asbestos Content
Gray Cove Base	ND
Beige Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-50B, 4" Gray Vinyl Cove Base with Beige Mastic - Portable Classroom 11, West within Classroom

Lab ID-Version‡: 21663390-1

Sample Layers	Asbestos Content
Gray Cove Base	ND
Beige Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-51A, Tagboard Wall Systems - Portable Classroom 11, East wall system

Lab ID-Version‡: 21663391-1

Sample Layers	Asbestos Content
Cream Adhesive	ND
Brown Fiberboard with Paint	ND
Composite Non-Asbestos Content:	80% Cellulose
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-51B, Tagboard Wall Systems - Portable Classroom 11, West wall system

Lab ID-Version‡: 21663392-1

Sample Layers	Asbestos Content
Cream Adhesive	ND
Brown Fiberboard with Paint	ND
Composite Non-Asbestos Content:	80% Cellulose
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-53A, 2' x 4' Acoustical Ceiling Tile with Smooth texture - Portable Classroom 11, South within Restroom

Lab ID-Version‡: 21663393-1

Sample Layers	Asbestos Content
White Ceiling Tile with Smooth Texture	ND
Composite Non-Asbestos Content:	10% Cellulose 2% Glass Fibers
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-53B, 2' x 4' Acoustical Ceiling Tile with Smooth texture - Portable Classroom 13, South within Restroom

Lab ID-Version‡: 21663394-1

Sample Layers	Asbestos Content
White Ceiling Tile with Smooth Texture	ND
Composite Non-Asbestos Content:	10% Cellulose 2% Glass Fibers
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-54A, 2' x 4' Acoustical Ceiling Tile with Pinhole Pattern - Portable Classroom 11, Center of Classroom

Lab ID-Version‡: 21663395-1

Sample Layers	Asbestos Content
Gray Ceiling Tile with White Surface	ND
Composite Non-Asbestos Content:	80% Cellulose 10% Glass Fibers
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-54B, 2' x 4' Acoustical Ceiling Tile with Pinhole Pattern - Portable Classroom 12, Center of Classroom Lab ID-Version‡: 21663396-1

Sample Layers	Asbestos Content
Gray Ceiling Tile with White Surface	ND
Composite Non-Asbestos Content:	80% Cellulose 10% Glass Fibers
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-55A, Beige Mastic Behind Fiberglass Reinforced Panels - Portable Classroom 11, South Wall in Restroom Lab ID-Version‡: 21663397-1

Sample Layers	Asbestos Content
White Fiberglass Reinforced Plastic	ND
Beige Mastic	ND
Composite Non-Asbestos Content:	10% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-55B, Beige Mastic Behind Fiberglass Reinforced Panels - Portable Classroom 13, South Wall in Restroom Lab ID-Version‡: 21663398-1

Sample Layers	Asbestos Content
White Fiberglass Reinforced Plastic	ND
Beige Mastic	ND
Composite Non-Asbestos Content:	10% Glass Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-56A, Wallpaper - Portable Classroom 11, East Wall Lab ID-Version‡: 21663399-1

Sample Layers	Asbestos Content
White Wallpaper	ND
Composite Non-Asbestos Content:	60% Cellulose
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-56B, Wallpaper - Portable Classroom 11, East Wall Lab ID-Version‡: 21663400-1

Sample Layers	Asbestos Content
White Wallpaper	ND
Composite Non-Asbestos Content:	60% Cellulose
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-57A, Black Carpet Over Gray Vinyl Floor Tile with Mastic - Portable Classroom 12, North within Classroom Lab ID-Version‡: 21663401-1

Sample Layers	Asbestos Content
Black Carpet	ND
Yellow Mastic	ND
Green Mastic	ND
Gray Leveling Compound	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-57B, Black Carpet Over Gray Vinyl Floor Tile with Mastic - Portable Classroom 13, North within Classroom Lab ID-Version‡: 21663402-1

Sample Layers	Asbestos Content
Black Carpet	ND
Yellow Mastic	ND
Green Mastic	ND
Gray Leveling Compound	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-58A, 6" Vinyl Base Cove with Beige Mastic - Portable Classroom 12, West Wall Lab ID-Version‡: 21663403-1

Sample Layers	Asbestos Content
Dark Gray Cove Base	ND
Beige Mastic	ND
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT

Location: ECG-25-7929-58B, 6" Vinyl Base Cove with Beige Mastic - Portable Classroom 20, West Wall

Lab ID-Version‡: 21663404-1

Sample Layers	Asbestos Content
Dark Gray Cove Base	ND
Beige Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-59A, 24" X 24" Blue Carpet Square over Gray Vinyl Floor Tile with Mastic - Portable Classroom 12, South within Classroom

Lab ID-Version‡: 21663405-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Beige Mastic	ND
Gray Leveling Compound	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-59B, 24" X 24" Blue Carpet Square over Gray Vinyl Floor Tile with Mastic - Portable Classroom 12, North within Classroom

Lab ID-Version‡: 21663406-1

Sample Layers	Asbestos Content
Blue Carpet	ND
Beige Mastic	ND
Gray Leveling Compound	ND
Composite Non-Asbestos Content:	80% Synthetic Fibers
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-60A, Wood Pattern Laminate Flooring - Portable Classroom 13 - North within Classroom

Lab ID-Version‡: 21663407-1

Sample Layers	Asbestos Content
Brown Flooring	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT

Location: ECG-25-7929-60B, Wood Pattern Laminate Flooring - Portable Classroom 20 - North within Classroom

Lab ID-Version‡: 21663408-1

Sample Layers	Asbestos Content
Brown Flooring	ND
Sample Composite Homogeneity:	Good

Location: ECG-25-7929-61A, 4" Blue Vinyl Cove Base with Beige Mastic - Portable Classroom 20 - South within Classroom

Lab ID-Version‡: 21663409-1

Sample Layers	Asbestos Content
Blue Cove Base	ND
Beige Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-61B, 4" Blue Vinyl Cove Base with Beige Mastic - Portable Classroom 13 - West Wall

Lab ID-Version‡: 21663410-1

Sample Layers	Asbestos Content
Blue Cove Base	ND
Beige Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-62A, Gray Vinyl Sheet Flooring with Mastic - Custodian Room - East within Room

Lab ID-Version‡: 21663411-1

Sample Layers	Asbestos Content
Gray Sheet Flooring with Fibrous Backing	ND
Beige Mastic	ND
Composite Non-Asbestos Content:	20% Cellulose
Sample Composite Homogeneity:	Moderate

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Date of Report: 12-04-2025

ASBESTOS PLM REPORT

Location: ECG-25-7929-62B, Gray Vinyl Sheet Flooring with Mastic - Custodian Room - North within Room

Lab ID-Version‡: 21663412-1

Sample Layers	Asbestos Content
Gray Sheet Flooring with Fibrous Backing	ND
Beige Mastic	ND
Composite Non-Asbestos Content:	20% Cellulose
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-63A, Gray Vinyl Sheet Flooring with Mastic - Portable Building Girls Restroom - West within Room

Lab ID-Version‡: 21663413-1

Sample Layers	Asbestos Content
Gray Sheet Flooring	ND
Beige Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: ECG-25-7929-63B, Gray Vinyl Sheet Flooring with Mastic - Portable Building Boys Restroom - West within Room

Lab ID-Version‡: 21663414-1

Sample Layers	Asbestos Content
Gray Sheet Flooring	ND
Beige Mastic	ND
Sample Composite Homogeneity:	Moderate

The test report shall not be reproduced except in full, without written approval of the laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. The Company reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified.

All components not quantified as asbestos content and non-asbestos content are considered to be non-fibrous matrix components. Matrix components may include, but are not limited to, gypsum, paint, silicate minerals, vinyl, binder, calcium carbonate, tar, and foam.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. ND means no fibers were detected. When detected, the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.
‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

eurofins | Built Environment Testing

ENTEK CONSULTING GROUP, INC.

Report for:

Jonathan Gonzalez
Entek Consulting Group
3435 American River Drive
Suite C
Sacramento, CA 95864

Regarding:
Eurofins Built Environment Testing West, LLC
Project: 25-7929; Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 9567
EML ID: 4326286

Approved by:



Approved Signatory
Amin Suliman

Dates of Analysis:
Asbestos-EPA 400 point count: 12-10-2025

Service SOPs: Asbestos-EPA 400 point count (EPA 40CFR App E to Sub E of Part 763 & EPA METHOD 600/R-93-116, SOP EB-AS-S-1262)
NVLAP Lab Code 200728-0

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank correction of results is not applied. The results relate only to the samples as received and tested.

Eurofins Built Environment Testing West, LLC ("the Company"), a member of the Eurofins Built Environment Testing group of companies, shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

Eurofins Built Environment Testing West, LLC
111 Anza Boulevard, Suite 122, Burlingame, CA 94010
(833) 465-5857 www.eurofinsus.com/Built

Client: Entek Consulting Group
C/O: Jonathan Gonzalez
Re: 25-7929; Cordova Villa Elementary School
10359 S White Rock Road, Rancho Cordova, CA 9567

Date of Sampling: 11-24-2025
Date of Receipt: 12-01-2025
Date of Report: 12-10-2025

ASBESTOS POINT COUNT REPORT

Location:	ECG-25-7929-09D Exterior Stucco - Main Office Buiding, West Exterior		
Total Points Counted:	400		
Lab ID-Version‡:	21699082-1		
Sample Layers	**Asbestos Type**	**Asbestos Points Counted**	**Asbestos Concentration (%)**
White Stucco with Paint	Chrysotile	1	0.25
Layer Totals:		1	0.25

Location:	ECG-25-7929-09E Exterior Stucco - Main Office Buiding, West Exterior		
Total Points Counted:	400		
Lab ID-Version‡:	21699083-1		
Sample Layers	**Asbestos Type**	**Asbestos Points Counted**	**Asbestos Concentration (%)**
White Stucco with Paint	Chrysotile	0	< 0.25
Layer Totals:		0	NA

Comments: Asbestos was detected, but no points counted.

Location:	ECG-25-7929-09F Exterior Stucco - Main Office Buiding, West Exterior		
Total Points Counted:	400		
Lab ID-Version‡:	21699084-1		
Sample Layers	**Asbestos Type**	**Asbestos Points Counted**	**Asbestos Concentration (%)**
White Stucco with Paint	Chrysotile	0	< 0.25
Layer Totals:		0	NA

Comments: Asbestos was detected, but no points counted.

The analytical sensitivity is 1 asbestos point. The limit of detection is 1 asbestos point divided by the total number of points counted and multiplied by 100.

The results relate only to the items tested. Interpretation is left to the company and/or persons who conducted the field work. The test report shall not be reproduced except in full, without written approval of the laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

All samples were received in acceptable condition unless otherwise noted. The Company reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified.
Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

Eurofins Built Environment Testing West, LLC
111 Anza Boulevard, Suite 122, Burlingame, CA 94010
(833) 465-5857 www.eurofinsus.com/Built

Client: Entek Consulting Group
C/O: Jonathan Gonzalez
Re: 25-7929; Cordova Villa Elementary School
10359 S White Rock Road, Rancho Cordova, CA 9567

Date of Sampling: 11-24-2025
Date of Receipt: 12-01-2025
Date of Report: 12-10-2025

ASBESTOS POINT COUNT REPORT

Location:	ECG-25-7929-09G Exterior Stucco - Main Office Buiding, West Exterior		
Total Points Counted:	400		
Lab ID-Version‡:	21699085-1		
Sample Layers	**Asbestos Type**	**Asbestos Points Counted**	**Asbestos Concentration (%)**
White Stucco with Paint	Chrysotile	0	< 0.25
Layer Totals:		0	NA

Comments: Asbestos was detected, but no points counted.

The analytical sensitivity is 1 asbestos point. The limit of detection is 1 asbestos point divided by the total number of points counted and multiplied by 100.

The results relate only to the items tested. Interpretation is left to the company and/or persons who conducted the field work. The test report shall not be reproduced except in full, without written approval of the laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

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Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

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ENTEK

BULK ASBESTOS MATERIAL *Analysis Request*

104326286

ENTEK CONSULTING GROUP, INC.
3435 AMERICAN RIVER DRIVE, SUITE C
SACRAMENTO, CA 95864
(916) 632-6800 PHONE
mainoffice@entekgroup.com

Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

Special Instructions: *Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.*

Please e-mail results at mainoffice@entekgroup.com and jgonzalez@entekgroup.com as soon as available and include copy of submittal with those results.

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-01A	Single Ply Roofing Membrane – Main Office Building Roof, West on Roof
ECG-25-7929-01B	Single Ply Roofing Membrane – Main Office Building Roof, North on Roof
ECG-25-7929-01C	Sample Number Not USED
ECG-25-7929-01D	Single Ply Roofing Membrane – Main Office Building Roof, East Parapet Wall on Roof
ECG-25-7929-02A	White Pipe Penetration Mastic – Main Office Building Roof, Southeast on Roof
ECG-25-7929-02B	White Pipe Penetration Mastic – Main Office Building Roof, South on Roof
ECG-25-7929-03A	White Insulation on HVAC Conduit – Main Office Building, Southeast on Roof
ECG-25-7929-03B	White Insulation on HVAC Conduit – Main Office Building, Southwest on Roof
ECG-25-7929-03C	White Insulation on HVAC Conduit – Main Office Building, South on Roof
ECG-25-7929-04A	Red Brick with Gray Mortar – Main Office Building, Southeast Exterior
ECG-25-7929-04B	SAMPLE NUMBER NOT USED
ECG-25-7929-04C	Red Brick with Gray Mortar – Main Office Building, West Exterior
ECG-25-7929-05A	Concrete Pillar – Main Office Building, South Exterior
ECG-25-7929-05B	Concrete Pillar – Main Office Building, North Exterior
ECG-25-7929-06A	Brown Asphaltic Roof Shingle – Main Office Building, North Exterior
ECG-25-7929-06B	Brown Asphaltic Roof Shingle – Main Office Building, Northeast Exterior
ECG-25-7929-07A	White Window Putty – Main Office Building, Northeast Exterior

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:15 AM/PM

Received by: _____ **Date:** 12/1/25 **Time:** 10:15 AM/PM

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Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

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SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-07B	White Window Putty – Main Office Building, Northeast Exterior
ECG-25-7929-08A	Concrete Foundation – Main Office Building, Southeast Exterior
ECG-25-7929-08B	Concrete Foundation – Main Office Building, Southeast Exterior
ECG-25-7929-09A	Exterior Stucco – Main Office Building, Southeast Exterior
ECG-25-7929-09B	Exterior Stucco – Main Office Building, Center East Exterior
ECG-25-7929-09C	Exterior Stucco – Main Office Building, North East Exterior
ECG-25-7929-09D	Exterior Stucco – Main Office Building, West Exterior
ECG-25-7929-09E	Exterior Stucco – Main Office Building, West Exterior
ECG-25-7929-09F	Exterior Stucco – Main Office Building, West Exterior
ECG-25-7929-09G	Exterior Stucco – Main Office Building, West Exterior
ECG-25-7929-10A	Caulking in Between Concrete Seams – Main Office Building, East Exterior
ECG-25-7929-10B	Caulking in Between Concrete Seams – Main Office Building, East Exterior
ECG-25-7929-11A	Rocky Pavement – Main Office Building, West Exterior
ECG-25-7929-11B	Rocky Pavement – Main Office Building, West Exterior
ECG-25-7929-12A	Terrazzo Flooring – Main Office Building, Exterior Boys Restroom, At Door Threshold
ECG-25-7929-12B	Terrazzo Flooring – Main Office Building, Exterior Boys Restroom, At Door Threshold
ECG-25-7929-12C	Terrazzo Flooring – Main Office Building, Exterior Girls Restroom, At Door Threshold

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:13 AM/PM

Received by: _____ **Date:** 12/1/25 **Time:** 10:15 AM/PM

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Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

Special Instructions: *Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.*

Please e-mail results at mainoffice@entekgroup.com and jgonzalez@entekgroup.com as soon as available and include copy of submittal with those results.

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-13A	Beige Mastic Behind Fiberglass Reinforced Paneling – Main Office Building, Exterior Girls Restroom
ECG-25-7929-13B	Beige Mastic Behind Fiberglass Reinforced Paneling – Main Office Building, Exterior Boys Restroom
ECG-25-7929-14A	Asphalt – Blacktop West of Main Office Building
ECG-25-7929-14B	Asphalt – Blacktop West of Main Office Building
ECG-25-7929-15A	Skim Coat on Drywall Wall System – Main Office Building, Exterior Girls Restroom, Janitorial Closet, North Wall
ECG-25-7929-15B	Skim Coat on Drywall Wall System – Main Office Building, Exterior Girls Restroom, Janitorial Closet, East Wall
ECG-25-7929-15C	Skim Coat Texture on Drywall Wall Systems – Main Office Building, Custodial Closet, South Wall
ECG-25-7929-16A	Drywall & Joint Compound – Main Office Building, Exterior Girls Restroom, Janitorial Closet, Northeast Corner
ECG-25-7929-16B	Drywall & Joint Compound – Main Office Building, Exterior Girls Restroom, Janitorial Closet, Southeast Corner
ECG-25-7929-17A	SAMPLE NUMBER NOT USED
ECG-25-7929-18A	SAMPLE NUMBER NOT USED
ECG-25-7929-19A	Black Window Putty – Main Office Building, West Exterior
ECG-25-7929-19B	Black Window Putty – Main Office Building, West Exterior

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:13 AM/PM

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Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

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SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-20A	Gray Penetration Mastic – Portable Buildings Exterior, Roof of Classrooms 14-17, North on Roof
ECG-25-7929-20B	Gray Penetration Mastic – Portable Buildings Exterior, Roof of Classrooms 18-23, Center on Roof
ECG-25-7929-21A	White Penetration Mastic – Portable Buildings Exterior, Roof of Classrooms 14-17, North on Roof
ECG-25-7929-21B	White Penetration Mastic – Portable Buildings Exterior, Roof of Classrooms 18-23, Center on Roof
ECG-25-7929-22A	Black Penetration Mastic – Portable Buildings Exterior, Roof of Classrooms 14-17, South on Roof
ECG-25-7929-22B	Black Penetration Mastic – Portable Buildings Exterior, Roof of Classrooms 18-23, South on Roof
ECG-25-7929-23A	White Penetration Mastic – Portable Buildings Exterior, HVAC Mastic, Roof of Classrooms 18-23, North on Roof
ECG-25-7929-23B	White Penetration Mastic – Portable Buildings Exterior, HVAC Mastic, Roof of Classrooms 18-23, South on Roof
ECG-25-7929-24A	Black Over Gray Penetration Mastic – Portable Buildings Exterior, North on Restroom Roof
ECG-25-7929-24B	Black Over Gray Penetration Mastic – Portable Buildings Exterior, Center of Restroom Roof
ECG-25-7929-25A	Dark Blue Carpet Sheeting with Yellow Mastic – Main Office Building, Main Adj. Room, Door Threshold

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:13 AM/PM

Received by: _____ **Date:** 12/1/25 **Time:** 10:15 AM/PM

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Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

Special Instructions: *Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.*

Please e-mail results at mainoffice@entekgroup.com and jgonzalez@entekgroup.com as soon as available and include copy of submittal with those results.

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-25B	Dark Blue Carpet Sheeting with Yellow Mastic – Main Office Building, Classroom 10 By Exit
ECG-25-7929-25C	Dark Blue Carpet Sheeting with Yellow Mastic – Main Office Building, North Main Adj. Room, Door Threshold
ECG-25-7929-26A	Light Blue Carpet Sheeting with Mastic – Main Office Building, Main Hallway, Door Threshold
ECG-25-7929-26B	Light Blue Carpet Sheeting with Mastic – Main Office Building, By Receptionist Door
ECG-25-7929-27A	12" x 12" White Vinyl Floor Tile with Green Mastic – Main Office Building, Classroom 4, By Exit
ECG-25-7929-27B	12" x 12" White Vinyl Floor Tile with Green Mastic – Main Office Building, Classroom 8, By Exit
ECG-25-7929-28A	12" x 12" Green Tint Vinyl Floor Tile with Brown Mastic – Main Office Building, Library By South Entrance
ECG-25-7929-28B	12" x 12" Green Tint Vinyl Floor Tile with Brown Mastic – Main Office Building, Printer Room by East Door
ECG-25-7929-29A	Gray Vinyl Sheet Flooring with Tan Mastic – Main Office Building, North Restroom at Door
ECG-25-7929-29B	Gray Vinyl Sheet Flooring with Tan Mastic – Main Office Building, South Restroom at Door
ECG-25-7929-30A	Green Carpet Sheeting – Main Office Building, Library, North within Room
ECG-25-7929-30B	Green Carpet Sheeting – Main Office Building, Library, South within Room
ECG-25-7929-31A	Wood Pattern Laminate Flooring – Main Office Building, Staff Lounge, By Fridge

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:13 AM/PM

Received by: _____ **Date:** 12/1/25 **Time:** 10:15 AM/PM

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SACRAMENTO, CA 95864
(916) 632-6800 PHONE
mainoffice@entekgroup.com

Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

Special Instructions: *Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.*

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SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-31B	Wood Pattern Laminate Flooring – Main Office Building, Staff Lounge, By Fridge
ECG-25-7929-32A	2' x 2' Blue Vinyl Floor Tile with Yellow Mastic – Main Office Building, Main Entrance by Door to Hallway
ECG-25-7929-32B	2' x 2' Blue Vinyl Floor Tile with Yellow Mastic – Main Office Building, Main Entrance by East Wall
ECG-25-7929-33A	4" Black Cove Base with Tan Mastic – Main Office Building, Hallway
ECG-25-7929-33B	4" Black Vinyl Cove Base with Tan Mastic – Main Office Building, By Hallway Cabinet
ECG-25-7929-34A	4" Blue Vinyl Cove Base with Mastic – Main Office Building, Front Reception Desk, East Wall
ECG-25-7929-34B	4" Blue Vinyl Cove Base with Mastic – Main Office Building, South Adj. Room, South Wall
ECG-25-7929-35A	Gray Wallpaper – Main Office Building Throughout, Room 6, Southeast Corner
ECG-25-7929-35B	Gray Wallpaper – Main Office Building Throughout, South Adj. Room, Northwest Corner
ECG-25-7929-36A	Tagboard – Main Office Building Throughout, Room 6, Southeast Corner
ECG-25-7929-36B	Tagboard – Main Office Building Throughout, South Adj. Room, Northwest Corner
ECG-25-7929-37A	Concrete Columns – Main Office Building, Room 8, West Column
ECG-25-7929-37B	Concrete Columns – Main Office Building, Room 8, East Column
ECG-25-7929-38A	Mastic Behind Fiberglass Reinforced Panels – Main Office Building, North Restroom, West Wall

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:13 AM/PM

Received by: _____ **Date:** 12/1/25 **Time:** 10:15 AM/PM

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BULK ASBESTOS MATERIAL *Analysis Request*



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SACRAMENTO, CA 95864
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Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

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SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-38B	Mastic Behind Fiberglass Reinforced Panels – Main Office Building, North Restroom, West Wall
ECG-25-7929-39A	Drywall and Joint Compound – Main Office Building, Custodial Closet, Northwest Corner
ECG-25-7929-39B	Drywall and Joint Compound – Main Office Building, Custodial Closet, Southwest Corner
ECG-25-7929-40A	SAMPLE NUMBER NOT USED
ECG-25-7929-41A	2' x 4' Drop-In Acoustical Ceiling Tile – Main Office Building, Classroom 9, North in Classroom
ECG-25-7929-41B	2' x 4' Drop-In Acoustical Ceiling Tile – Main Office Building, Classroom 3, South in Classroom
ECG-25-7929-42A	12" x 12" Glued on Acoustical Ceiling Tiles with Mastic – Main Office Building, North Hallway Adjacent to Restroom
ECG-25-7929-42B	12" x 12" Glued on Acoustical Ceiling Tiles with Mastic – Main Office Building, South in South Adj. Room
ECG-25-7929-43A	Heating, Ventilation, and Air Conditioning Duct Mastic – Main Office Building, South in South Adj. Room
ECG-25-7929-43B	Heating, Ventilation, and Air Conditioning Duct Mastic – Main Office Building, North in Classroom 9
ECG-25-7929-44A	Drywall and Joint Compound – Main Office Building, South Restroom
ECG-25-7929-44B	Drywall and Joint Compound – Main Office Building, Printer Room
ECG-25-7929-45A	Orange Peel Wall Texture - Main Office Building, Printer Room, West Wall

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SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-45B	Orange Peel Wall Texture - Main Office Building, Printer Room, West Wall
ECG-25-7929-45C	Orange Peel Wall Texture - Main Office Building, Printer Room, East Wall
ECG-25-7929-45D	Orange Peel Texture on Drywall – Main Office Building, Janitorial Closet in Between Boys and Girls Restroom, Southwest Corner
ECG-25-7929-45E	Orange Peel Texture on Drywall – Main Office Building, Janitorial Closet in Between Boys and Girls Restroom, Southwest Corner
ECG-25-7929-46B	Remnant Black Vinyl Base Cove Mastic - Main Office Building, Custodial Closet, West Wall
ECG-25-7929-47A	Skim Coat Ceiling Texture - Main Office Building, South Restroom, Ceiling
ECG-25-7929-47B	Skim Coat Ceiling Texture - Main Office Building, North Restroom, Ceiling
ECG-25-7929-47C	Skim Coat Ceiling Texture - Main Office Building, North Restroom, Ceiling
ECG-25-7929-48A	Gray Vinyl Sheet Flooring with Yellow Mastic – Portable Classroom 11, East within Classroom
ECG-25-7929-48B	Gray Vinyl Sheet Flooring with Yellow Mastic – Portable Classroom 11, East within Classroom
ECG-25-7929-49A	Blue Carpet Sheeting with Mastic – Portable Classroom 13, North within Classroom
ECG-25-7929-49B	Blue Carpet Sheeting with Mastic – Portable Classroom 12, North within Classroom
ECG-25-7929-50A	4" Gray Vinyl Cove Base with Beige Mastic – Portable Classroom 11, West within Classroom

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:13 AM/PM

Received by: _____ **Date:** 12/1/25 **Time:** 10:14 AM/PM

ENTEK

BULK ASBESTOS MATERIAL *Analysis Request*

104326286

ENTEK CONSULTING GROUP, INC.
3435 AMERICAN RIVER DRIVE, SUITE C
SACRAMENTO, CA 95864
(916) 632-6800 PHONE
mainoffice@entekgroup.com

Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

Special Instructions: *Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.*

Please e-mail results at mainoffice@entekgroup.com and jgonzalez@entekgroup.com as soon as available and include copy of submittal with those results.

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-50B	4" Gray Vinyl Cove Base with Beige Mastic – Portable Classroom 13, West within Classroom
ECG-25-7929-51A	Tagboard Wall Systems – Portable Classroom 11, East Wall System
ECG-25-7929-51B	Tagboard Wall Systems – Portable Classroom 12, West Wall System
ECG-25-7929-52A	SAMPLE NUMBER NOT USED
ECG-25-7929-53A	2' x 4' Acoustical Ceiling Tile with Smooth Texture – Portable Classroom 11, South within Restroom
ECG-25-7929-53B	2' x 4' Acoustical Ceiling Tile with Smooth Texture – Portable Classroom 13, South within Restroom
ECG-25-7929-54A	2' x 4' Acoustical Ceiling Tile with Pinhole Pattern – Portable Classroom 11, Center of Classroom
ECG-25-7929-54B	2' x 4' Acoustical Ceiling Tile with Pinhole Pattern – Portable Classroom 12, Center of Classroom
ECG-25-7929-55A	Beige Mastic Behind Fiberglass Reinforced Panels – Portable Classroom 11, South Wall in Restroom
ECG-25-7929-55B	Beige Mastic Behind Fiberglass Reinforced Panels – Portable Classroom 13, South Wall in Restroom
ECG-25-7929-56A	Wallpaper – Portable Classroom 11, East Wall
ECG-25-7929-56B	Wallpaper – Portable Classroom 12, East Wall
ECG-25-7929-57A	Black Carpet Over Gray Vinyl Floor Tile with Mastic – Portable Classroom 12, North within Classroom

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:13 AM/PM

Received by: _____ **Date:** 12/1/25 **Time:** 10:15 AM/PM

ENTEK
BULK ASBESTOS MATERIAL *Analysis Request*

104326286

ENTEK CONSULTING GROUP, INC.
3435 AMERICAN RIVER DRIVE, SUITE C
SACRAMENTO, CA 95864
(916) 632-6800 PHONE
mainoffice@entekgroup.com

Date of Sampling: 11/24/25
Job Number: 25-7929
Client Name: Folsom Cordova Unified School District
Site Address: Cordova Villa Elementary School 10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Eurofins/EmLab P&K – Folsom
Collected by: Jonathan Gonzalez & Karl Suarez
Turnaround Time:

Analysis Requested: Asbestos by PLM with Dispersion Staining

Special Instructions: *Stop analysis upon first positive result (>1%) for sample in a series. Also stop analysis upon first positive result (>1%) in the joint compound for sample series.*

Please e-mail results at mainoffice@entekgroup.com and jgonzalez@entekgroup.com as soon as available and include copy of submittal with those results.

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-57B	Black Carpet Over Gray Vinyl Floor Tile with Mastic – Portable Classroom 13, North within Classroom
ECG-25-7929-58A	6" Vinyl Base Cove with Beige Mastic – Portable Classroom 12, West Wall
ECG-25-7929-58B	6" Vinyl Base Cove with Beige Mastic – Portable Classroom 20, West Wall
ECG-25-7929-59A	24" x 24" Blue Carpet Square Over Gray Vinyl Floor Tile with Mastic – Portable Classroom 12, South Within Classroom
ECG-25-7929-59B	24" x 24" Blue Carpet Square Over Gray Vinyl Floor Tile with Mastic – Portable Classroom 12, North Within Classroom
ECG-25-7929-60A	Wood Pattern Laminate Flooring – Portable Classroom 13 - North within Classroom
ECG-25-7929-60B	Wood Pattern Laminate Flooring – Portable Classroom 20 - North within Classroom
ECG-25-7929-61A	4" Blue Vinyl Cove Base with Beige Mastic – Portable Classroom 20 – South within Classroom
ECG-25-7929-61B	4" Blue Vinyl Cove Base with Beige Mastic – Portable Classroom 13 – West Wall
ECG-25-7929-62A	Gray Vinyl Sheet Flooring with Mastic – Custodian Room – East within Room
ECG-25-7929-62B	Gray Vinyl Sheet Flooring with Mastic – Custodian Room – North within Room
ECG-25-7929-63A	Gray Vinyl Sheet Flooring with Mastic – Portable Building Girls Restroom – West Within Room
ECG-25-7929-63B	Gray Vinyl Sheet Flooring with Mastic – Portable Building Boys Restroom – West Within Room

Delivered by: _____ **Date:** 12/1/25 **Time:** 10:13 AM/PM

Received by: _____ **Date:** 12/1/25 **Time:** 10:15 AM/PM

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Asbestos Survey Form

(See Instructions)

777 12th Street, 3rd Floor
Sacramento, CA 95814
Office (916) 874-4800
Fax (916) 874-4899
Email:
asbestos@airquaility.org

1. Purpose of Survey	✔ Renovation	✔ Demolition

2. Facility Information

Project Area(s) Description			
Cordova Villa Elementary School - Main Building, Portable Structure (11-13), and Portable Structu			
Address: 10359 South White Rock Road	City: Rancho Cordova	# of Structures: 3	

3. Owner Information

Name: Folsom Cordova USD			
Address: 1965 Birkmont Drive	City/State: Rancho Cordova/CA	Zip: 95742	
Contact: Mike Hammond	Phone: 916) 806-0752	Fax:	Email: mhammond@fcusd.net

4. Consultant Information — **Survey Date(s):** 11-24-25

Company Name: Entek Consulting Group, Inc.			
Name: Jonathan Gonzalez		DOSH #: 22-7153	
Address: 3435 American River Drive, Suite C	City/State: Sacramento, California	Zip: 95864	
Phone: (916) 632-6800	Fax:	Email: jgonzalez@entekgroup.com	Signature:

5. Client Information (If different than owner) ☐ General Contractor ☐ Insurance Company ☐ Architect ☐ Property Manager ☐ Other _____

Name			
Address	City/State	Zip	
Contact	Phone / Fax	Email	

6. Have all of the suspect materials that will be disturbed been sampled?	■ Yes ☐ No

If no, explain why:

7. Summary of Total Asbestos Containing Material (ACM) Findings

Regulated Asbestos Containing Material (RACM) (Includes materials subject to known mechanical removal and fire damaged materials)			Category II		Category I	
Square Ft.	Linear Ft.	Cubic Ft.	Square Ft.	Linear Ft.	Square Ft.	Linear Ft.
600	0	0	0	0	0	0

To receive future SMAQMD Rule updates and changes affecting your industry (check one box):

☐ Please send e-mail notices to ☐ I will sign up myself at www.airquality.org/listserve/ to receive emailed notices.

■ I am already subscribed. ☐ I want the District to mail notices to the address on this application: ☐ Owner ☐ Consultant

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Asbestos Renovation/Demolition Notification Form

777 12th Street, 3rd Floor
Sacramento, CA 95814
Office (279) 207-1122
Fax (279) 207-1144
Asbestos@airquality.org

1	Building Department Permit Application # (if known) : _____	☑ Renovation (Do not complete Section 5) ☑ Demolition (Complete all sections) ☐ Ordered Demo - Attach ordered demo letter ☐ Emergency Demo - SMAQMD Emergency #: _____

2	Contractor	Owner Folsom Cordova USD - Mike Hammond
	Address	Address 1965 Birkmont Drive
	City, State / Zip	City, State / Zip Rancho Cordova, CA 95742
	Email	Email mhammond@fcusd.net
	Telephone	Telephone 916) 806-0752

3	Structure Name Main Building, Portable Structure (11-13), and P	Renovation Area Main Building, Portable Structure (11-13), and P	# of Floors 1
	Project Address 10359 South White Rock Road	City / Zip Rancho Cordova 95670	Year Built Unknown

4	**Preference for return of form**	☐ **E-mail :**	☐ **Other :**

DEMOLITION ONLY – Start date must be at least 10 working days from the day of your postmark or hand delivery of this form.

5	Start Date _____ _____ _____ Completion Date _____ _____ _____	Revision # 1 2 3 4 5 6 7 8 9 (circle) New Start Date _____ _____ _____ New Completion Date _____ _____ _____
	Method of Demo (Check Applicable): ☐Manual/Hand Tools ☐Mechanical/Heavy Equipment ☐Other	
	Procedure to be followed if RACM is found or Category II material becomes friable:	

I have read and understand the directions. The information on this form is true and accurate.
I certify that the asbestos survey conducted represents the facility as built.

6	Applicant Name (Print)	☐ Owner ☐ Rep / Agent ☐ Contractor	**Permit may be issued on:**
	Phone Number		
	Applicant's Signature	Date	

Have DOSH Consultant complete and sign below OR attach completed Asbestos Survey Form and Consultant's report.

CONSULTANT USE ONLY

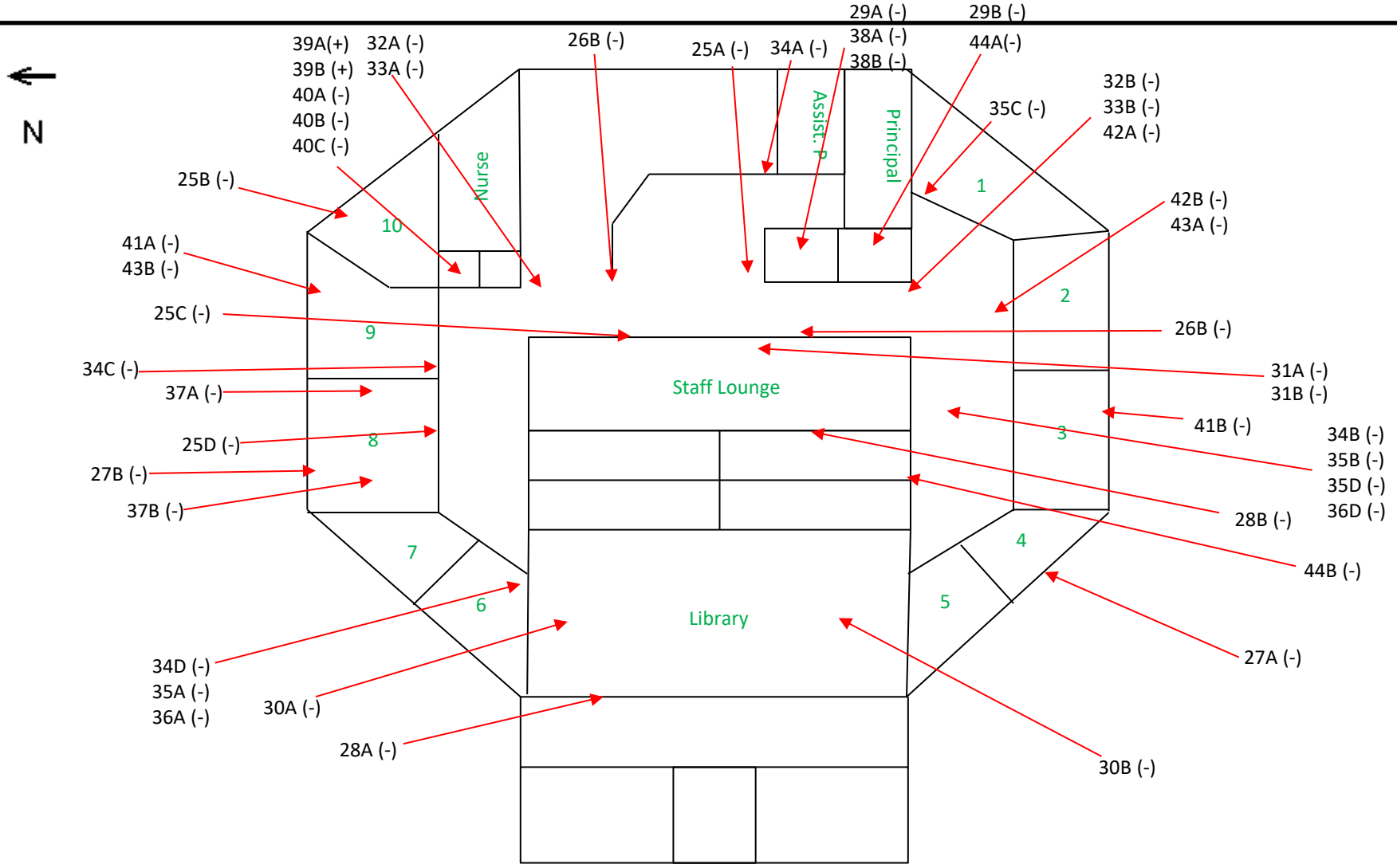
Company Name Entek Consulting Group, Inc.		Telephone (916) 632-6800	
Surveyor Name Jonathan Gonzalez		DOSH # 22-7153	Survey Date 11-24-25
Analytical Method PLM by Dispersion Staining		Pt Count Materials <10%? ☑Yes ☐ No ☐ Declined by Client	
Amount of RACM	Square Feet 600	Linear Feet 0	Cubic Feet 0
Amount of Category I 0		Amount of Category II 0	
Project Address 10359 South White Rock Road		City Rancho Cordova	Zip 95670
Suspect Materials Present? ☑Yes ☐ No		Consultant's Signature	

SMAQMD USE ONLY

Date Received / Date Postmarked _____ Date Approved & Returned _____

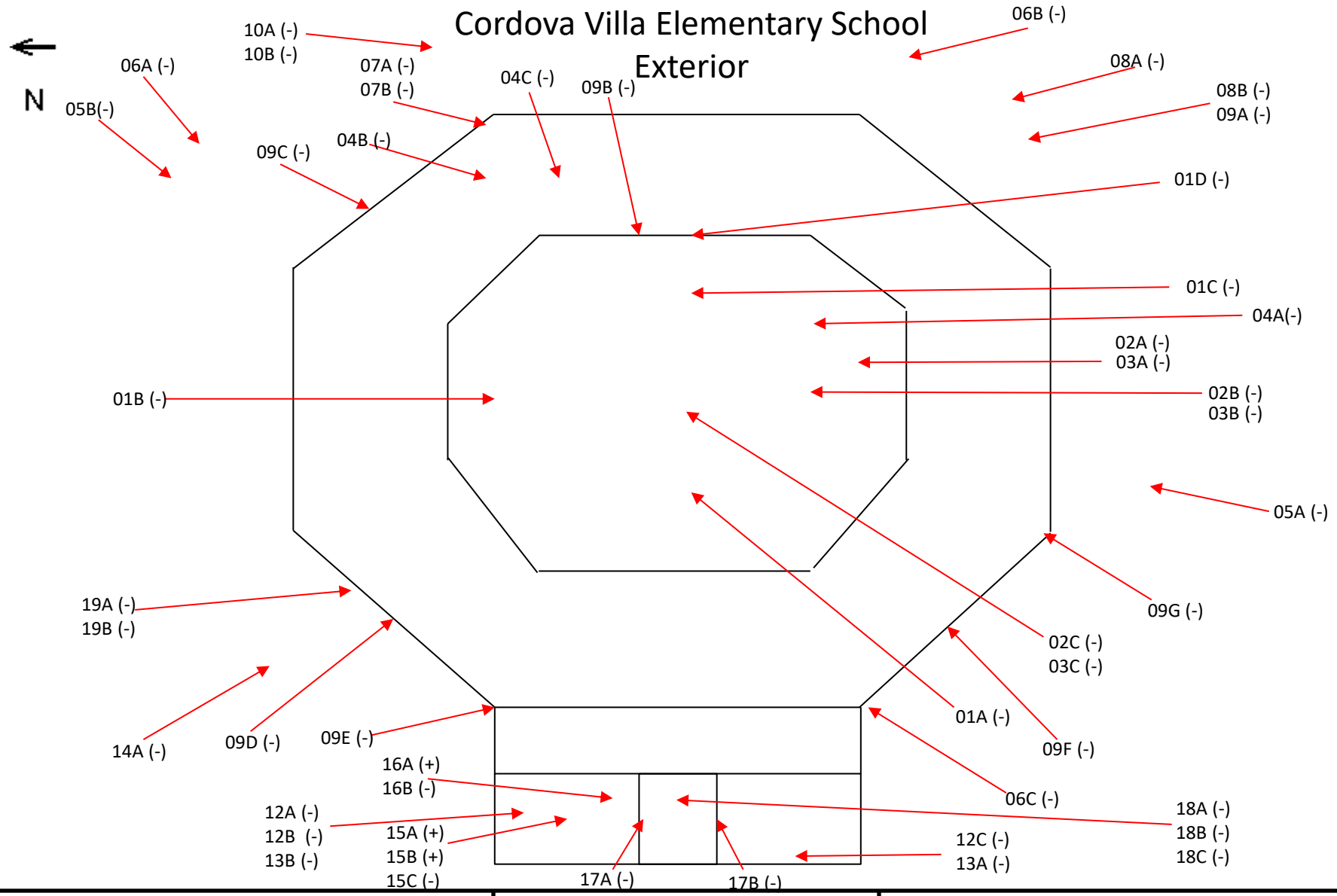
Project # _____ Check # _____ Receipt # _____ Amount Paid _____ Staff _____

Revised June 2021

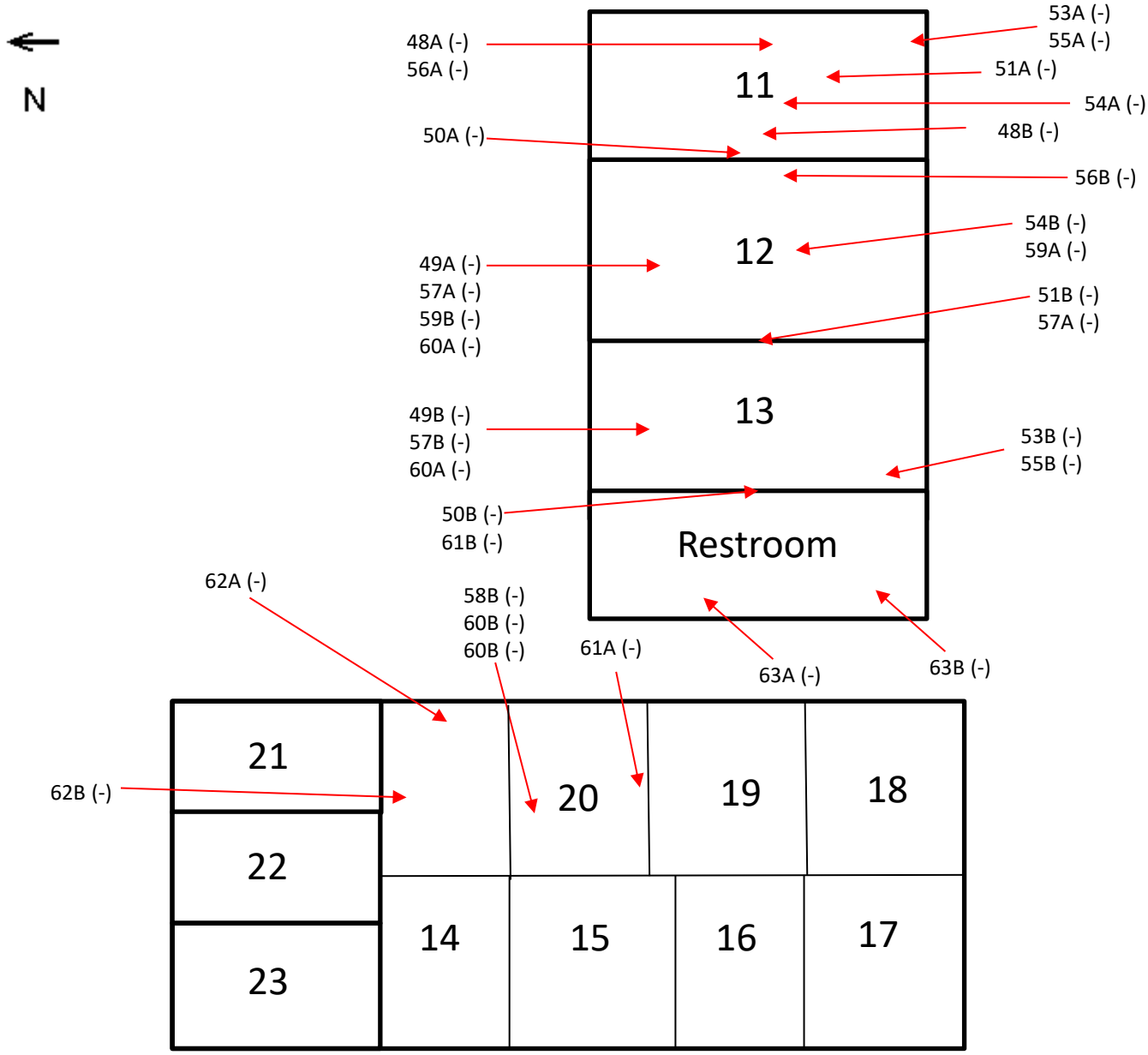


Folsom Cordova Unified School District Cordova Villa Elementary School 10359 South White Rock Road Rancho Cordova, CA 95670	Entek Consulting Group, Inc. 3435 American River Dr, Ste C Sacramento, CA 95864 Map Not to Scale	Bulk Asbestos Sampling Map Collected by Jonathan Gonzalez & Karl Suarez On 11/24/25 Project Number 25-7929

Cordova Villa Elementary School
Exterior

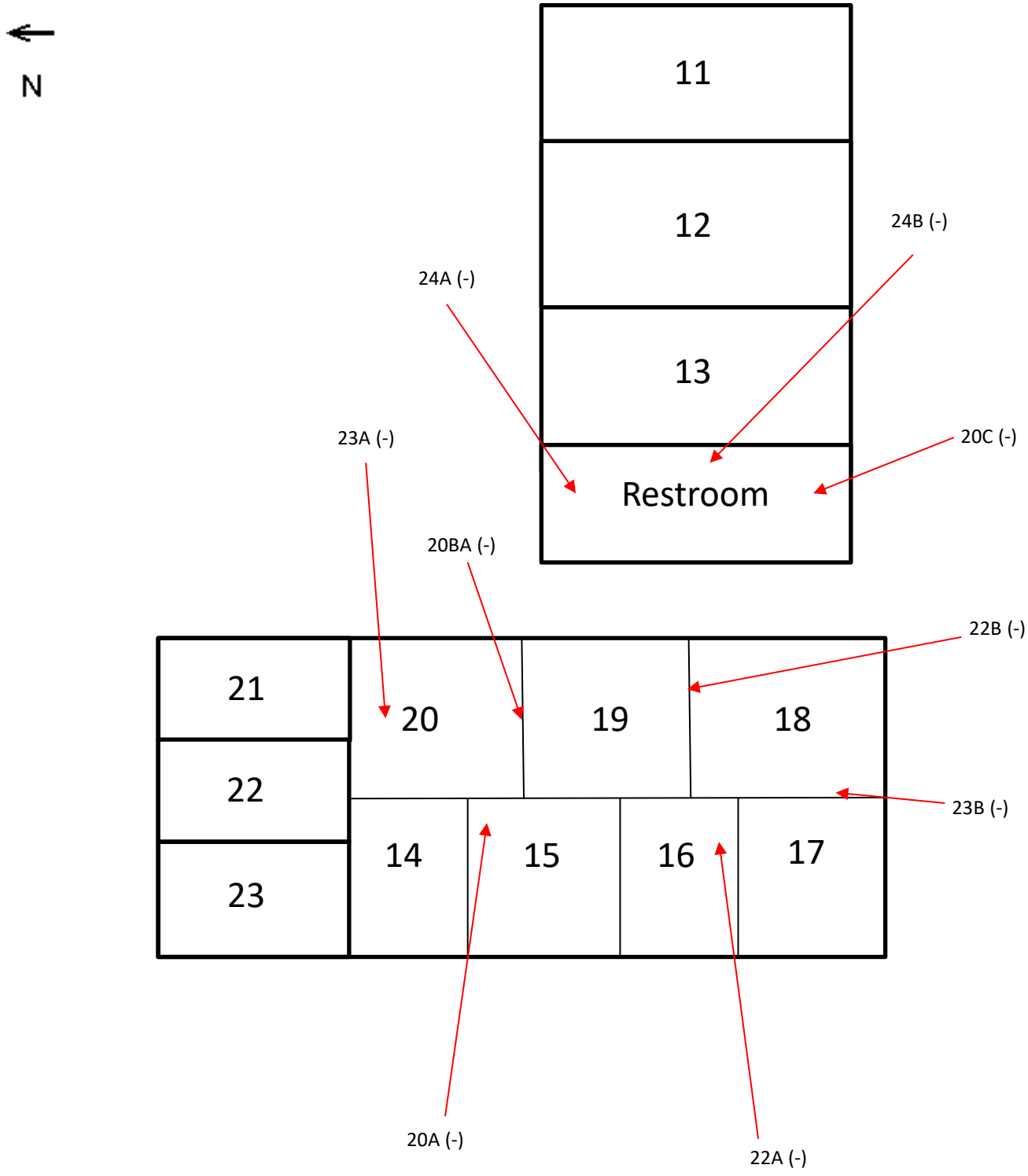


Folsom Cordova Unified School District Cordova Villa Elementary School 10359 South White Rock Road Rancho Cordova, CA 95670	Entek Consulting Group, Inc. 3435 American River Dr, Ste C Sacramento, CA 95864 Map Not to Scale	Bulk Asbestos Sampling Map Collected by Jonathan Gonzalez & Karl Suarez On 11/24/25 Project Number 25-7929



Cordova Villa Elementary School
Portable Buildings – Interior

Folsom Cordova Unified School District Cordova Villa Elementary School 10359 South White Rock Road Rancho Cordova, CA 95670	Entek Consulting Group, Inc. 3435 American River Dr, Ste C Sacramento, CA 95864 Map Not to Scale	Bulk Asbestos Sampling Map Collected by Jonathan Gonzalez & Karl Suarez On 11/24/25 Project Number 25-7929



Cordova Villa Elementary School
Portable Buildings – Exterior

Folsom Cordova Unified School District Cordova Villa Elementary School 10359 South White Rock Road Rancho Cordova, CA 95670	Entek Consulting Group, Inc. 3435 American River Dr, Ste C Sacramento, CA 95864 Map Not to Scale	Bulk Asbestos Sampling Map Collected by Jonathan Gonzalez & Karl Suarez On 11/24/25 Project Number 25-7929

ENTEK

APPENDIX B

LEAD RELATED DOCUMENTS

- Bulk Request Analysis from Microtest
- Bulk Analysis Request Form from Entek
- CDPH Form 8552
- Sampling Map

MicroTest Laboratories, Inc. | AIHA ELPAT #160934
3110 Gold Canal Dr, Ste. A, Rancho Cordova, CA 95670
PH 916.567.9808 | FX 916.404.0302
www.microtestlabsinc.com | service@microtestlabsinc.com

****for office use only****

Project ID

77564

CLIENT INFORMATION

Company Name	Entek Consulting Group, Inc
Address	3435 American River Drive Sacrmento, CA 95864
Phone	916.632.6800
Email	mainoffice@entekgroup.com

SAMPLE

Date	Monday, November 24, 2025
Time	

MicroTest Laboratories

Analytical Report

JOB SITE INFORMATION

Sampler	Jonathan Gonzalez
Project	Folsom Cordova Unified School District
Site	Cordova Villa Elementary School
Address	10359 S White Rock Road Rancho Cordova, CA 95670
Job #	25-7929

Lead in Paint/Bulk Analysis by Flame AA - EPA METHOD 7420/7000B

Client Sample ID	Laboratory Sample ID	Client Sample Description	Matrix	Results	Reporting Limits (RL)	Comments
ECG-25-7929-01Pb	77564-1	Blue Paint on Metal Roof Cap - Main Building Roof System	Paint/Bulk	<RL % Wt	0.01 %Wt	
				<RL PPM	100 PPM	
ECG-25-7929-02Pb	77564-2	White Paint on Interior Drywall - Main Building	Paint/Bulk	0.08 % Wt	0.01 %Wt	
				838.99 PPM	100 PPM	
ECG-25-7929-03Pb	77564-3	Baby Blue Paint on Interior Drywall - Main Building	Paint/Bulk	<RL % Wt	0.01 %Wt	
				<RL PPM	100 PPM	
ECG-25-7929-04Pb	77564-4	Lead Jacket - Main Building Roof System	Paint/Bulk	92.51 % Wt	2 %Wt	
				925067 PPM	20000 PPM	
ECG-25-7929-05Pb	77564-5	Tan Paint on Wood Siding - Main Building	Paint/Bulk	<RL % Wt	0.01 %Wt	
				<RL PPM	100 PPM	
ECG-25-7929-06Pb	77564-6	Brown Paint on Exterior Wood Support - Main Building	Paint/Bulk	<RL % Wt	0.01 %Wt	
				<RL PPM	100 PPM	
ECG-25-7929-07Pb	77564-7	Yellow Paint on Concrete Pavement - Exterior	Paint/Bulk	<RL % Wt	0.01 %Wt	
				<RL PPM	100 PPM	
ECG-25-7929-08Pb	77564-8	Red Paint on Concrete Pavement - Exterior	Paint/Bulk	<RL % Wt	0.01 %Wt	
				<RL PPM	100 PPM	

Date Received:	Monday, December 1, 2025
Date Analyzed:	Monday, December 1, 2025
Date Reported:	Tuesday, December 2, 2025

Analyst: **Erich Bowman**

Authorized Signatory:

Kelly Favero - Lab Manager

This report applies to the standards and procedures indicated to the specific samples analyzed. Samples have NOT been corrected for blank values. EPA 3050B Mod.

ENTEK

BULK LEAD MATERIAL Analysis *Request*

ENTEK CONSULTING GROUP, INC.
3435 AMERICAN RIVER DR
SACRAMENTO, CA 95864
(916) 632-6800 PHONE
(916) 632-6812 FAX
mainoffice@entekgroup.com

Project ID: 77564
Client: Entek
Received Date: 12/01/25
Count: 1 **TAT:** 1 Day

Date of Sampling: 11/24/25

Job Number: 25-7929

Client Name: Folsom Cordova Unified School District

Site Address: Cordova Villa Elementary School

10359 S White Rock Road, Rancho Cordova, CA 95670

Lab: Microtest

Collected by: Jonathan Gonzalez

Turnaround Time: [redacted]
Standard TAT

ANALYSIS REQUESTED: ICP Bulk for Lead

Special Instructions: *Please report result in PPM and % by weight. Please e-mail results at mainoffice@entekgroup.com and jgonzalez@entekgroup.com as soon as available.*

SAMPLE #	MATERIAL DESCRIPTION/LOCATION
ECG-25-7929-01Pb	Blue Paint on Metal Roof Cap – Main Building Roof System
ECG-25-7929-02Pb	White Paint on Interior Drywall – Main Building
ECG-25-7929-03Pb	Baby Blue Paint on Interior Drywall – Main Building
ECG-25-7929-04Pb	Lead Jacket – Main Building Roof System
ECG-25-7929-05Pb	Tan Paint on Wood Siding – Main Building
ECG-25-7929-06Pb	Brown Paint on Exterior Wood Support – Main Building
ECG-25-7929-07Pb	Yellow Paint on Concrete Pavement - Exterior
ECG-25-7929-08Pb	Red Paint on Concrete Pavement - Exterior

C:\Users\Jon\Desktop\Bulk Pb Rqst 11-4-22 ACC.docx

12/1/25 10 am

Delivered by: Jonathan Gonzalez **Date:** ~~11-19-25~~ **Time:** ~~2:00 PM~~

Received by: Mari Ee Encarnacion **Date:** 12/01/25 **Time:** 10:40 AM/PM

LEAD HAZARD EVALUATION REPORT

Section 1 — Date of Lead Hazard Evaluation 11-24-25

Section 2 — Type of Lead Hazard Evaluation (Check one box only)

☑ Lead Inspection ☐ Risk assessment ☐ Clearance Inspection ☐ Other (specify) _____

Section 3 — Structure Where Lead Hazard Evaluation Was Conducted

Address [number, street, apartment (if applicable)]	City	County	Zip Code
10359 South White Rock Road	Rancho Corodva	Sacramento	95670

Construction date (year) of structure: Unknown

Type of structure: ☐ Multi-unit building ☑ School or daycare ☐ Single family dwelling ☐ Other_____

Children living in structure? ☐ Yes ☑ No ☐ Don't Know

Section 4 — Owner of Structure (if business/agency, list contact person)

Name	Telephone number
Folsom Cordova USD - Mike Hammond	916) 806-0752

Address [number, street, apartment (if applicable)]	City	State	Zip Code
1965 Birkmont Drive	Rancho Cordova	CA	95742

Section 5 — Results of Lead Hazard Evaluation (check all that apply)

☐ No lead-based paint detected ☑ Intact lead-based paint detected ☐ Deteriorated lead-based paint detected

☐ No lead hazards detected ☐ Lead-contaminated dust found ☐ Lead-contaminated soil found ☐ Other_____

Section 6 — Individual Conducting Lead Hazard Evaluation

Name	Telephone number
Entek Consulting Group, Inc. - Jonathan Gonzalez	(916) 632-6800

Address [number, street, apartment (if applicable)]	City	State	Zip Code
3435 American River Drive, Suite C	Sacramento	CA	95864

CDPH certification number	Signature	Date
11323		11-24-25

Name and CDPH certification number of any other individuals conducting sampling or testing (if applicable)

Karl Suarez - 11068

Section 7 — Attachments

A. A foundation diagram or sketch of the structure indicating the specifc locations of each lead hazard or presence of lead-based paint;
B. Each testing method, device, and sampling procedure used;
C. All data collected, including quality control data, laboratory results, including laboratory name, address, and phone number.

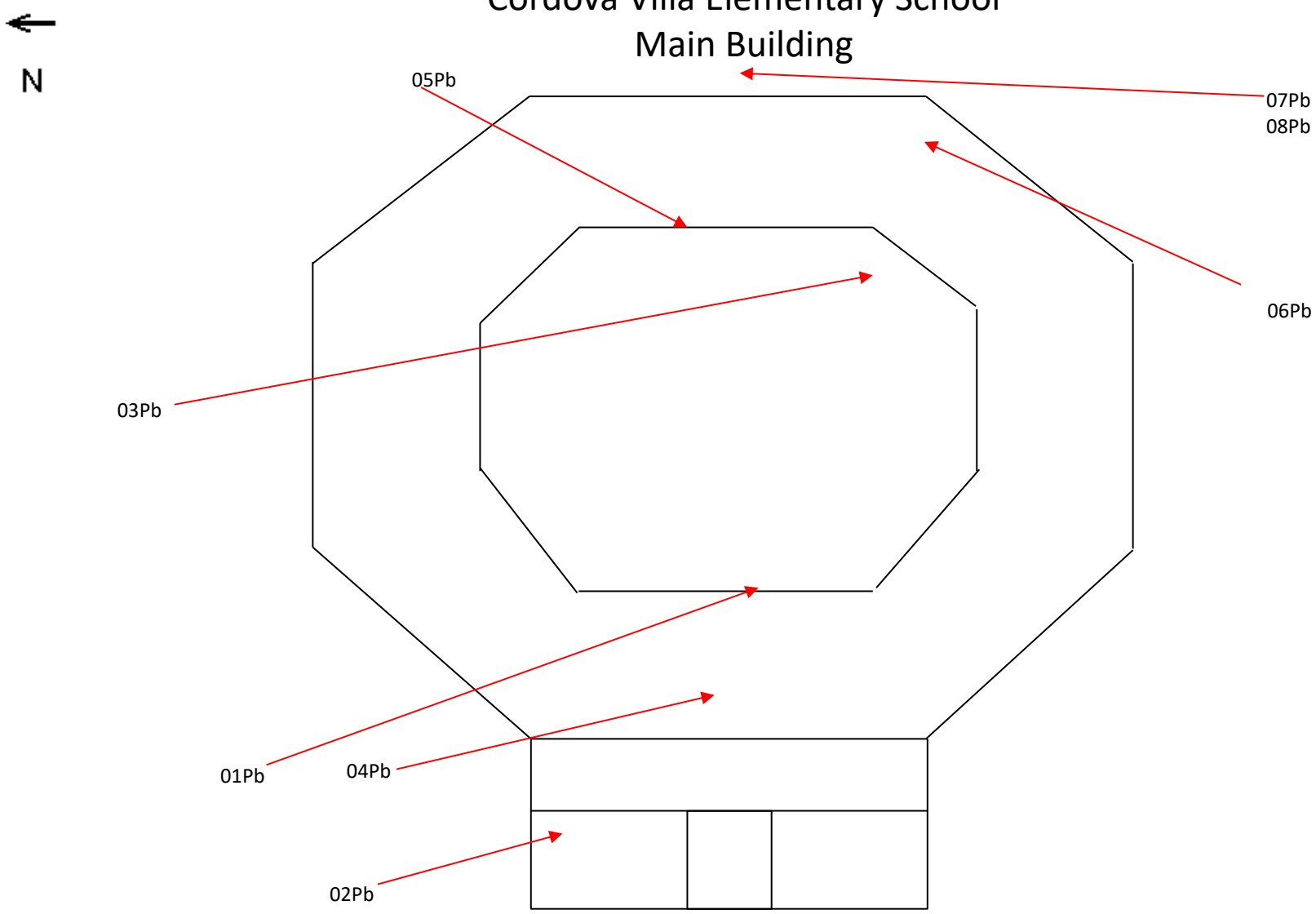
First copy and attachments retained by inspector

Second copy and attachments retained by owner

Third copy only (no attachments) mailed or faxed to:

California Department of Public Health
Childhood Lead Poisoning Prevention Branch Reports
850 Marina Bay Parkway, Building P, Third Floor
Richmond, CA 94804-6403
Fax: (510) 620-5656

Cordova Villa Elementary School
Main Building



Folsom Cordova Unified School District Cordova Villa Elementary School 10359 South White Rock Road Rancho Cordova, CA 95670	Entek Consulting Group, Inc. 3435 American River Dr, Ste C Sacramento, CA 95864 Map Not to Scale	Bulk LEad Sampling Map Collected by Jonathan Gonzalez & Karl Suarez On 11/24/25 Project Number 25-7929

ENTEK

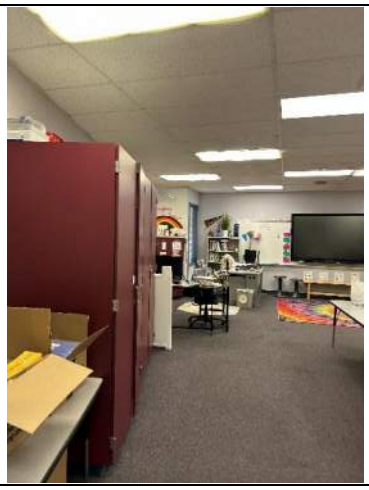
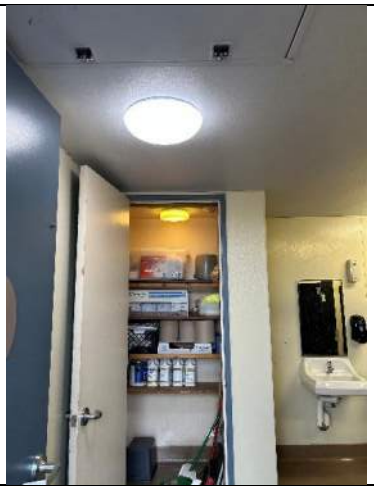
APPENDIX C

BACK UP DOCUMENTS

- Photo Log
- Inspector Accreditations and Certifications
- Laboratory Accreditations

Photo Log

Job Number:	25-7929	Date:	11-24-25
Client:	Folsom Cordova USD		
Site Address:	Cordova Villa ES – 10359 South White Rock Road Rancho Cordova, CA		

	
View of Standard Classroom with Main Building.	View Above Ceiling within Main Building.
	
View of Custodial Closet within Exterior Girls Restroom.	View of Custodial Closet adjacent to Front receptionist area.

State of California
Division of Occupational Safety and Health
Certified Asbestos Consultant

Jonathan A Gonzalez

Name



Certification No. **22-7153**

Expires on **07/15/2026**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq of the Business and Professions Code.

California Department of PublicHealth

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH

LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:	CERTIFICATE TYPE:	NUMBER:	EXPIRATION DATE:
 **Jonathan Gonzalez**	Lead Inspector/Assessor	LRC-00011323	6/7/2026

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD

State of California
Division of Occupational Safety and Health
Certified Asbestos Consultant

Karl S. Suarez

Name



Certification No. **23-7390**

Expires on **06/16/2026**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq of the Business and Professions Code.

California Department of PublicHealth

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH

LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:	CERTIFICATE TYPE:	NUMBER:	EXPIRATION DATE:
 **Karl Suarez**	Lead Inspector/Assessor	LRC-00011068	4/7/2026

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 600397-0

Eurofins Built Environment Testing West- Sacramento, CA

Folsom, CA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique on ISO/IEC 17025).

2025-10-01 through 2026-09-30

Effective Dates

For the National Voluntary Laboratory Accreditation Program

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

CERTIFICATE OF ENVIRONMENTAL LABORATORY ACCREDITATION

Is hereby granted to

MicroTest Laboratories, Inc.

3110 Gold Canal Drive

Rancho Cordova, CA 95670

Scope of the certificate is limited to the
"Fields of Accreditation"
which accompany this Certificate.

Continued accredited status depends on compliance with applicable laws and regulations, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2974**

Effective Date: **7/1/2024**

Expiration Date: **6/30/2026**

Sacramento, California
subject to forfeiture or revocation

Christine Sotelo, Program Manager
Environmental Laboratory Accreditation Program