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SECTION 02 82 14 – ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

A. AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)

AIHA Z9.2	(2006) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

B. ASTM INTERNATIONAL (ASTM)

ASTM D 4397	(2010) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 1368	(2005e1) Visual Inspection of Asbestos Abatement Projects

C. COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7	(2008) Compressed Air for Human Respiration; 6th Edition

D. INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2010) Occupational and Educational Personal Eye and Face Protection Devices

E. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2010) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

F. NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 94-113	(1994; 4th Ed) NIOSH Manual of Analytical Methods

G. NATIONAL PARK SERVICE (NPS)

50B	Reference Manual for Occupational Safety and Health Program

H. U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90/018	(1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance

I. U.S. NATIONAL ARCHIVE AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection
29 CFR 1910.141	Sanitation
29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1926.1101	Asbestos
29 CFR 1926.32	Safety and Health Regulations for Construction - Definition
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 763	Asbestos
42 CFR 84	Approval of Respiratory Protective Devices
49 CFR 107	Hazardous Materials Program Procedures
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packaging

J. UNDERWRITERS LABORATORIES (UL)

UL 586	(2009) Standard for High-Efficiency Particulate, Air Filter Units

K. CALIFORNIA DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH

California Code of Regulations, Title 8, Section 1529. Asbestos.

L. GOLDEN GATE NATIONAL RECREATION AREA (GGNRA)

SOP 829	Survey and Notification Requirements for Bldg. Demolition and Renovation
SOP 807	Hazard Communication Program
SOP 821	Asbestos Exposure Control Program

M. ENVIRONMENTAL REPORT REFERENCE MATERIALS

For a listing of asbestos materials, quantities and locations, refer to Table 02 82 14-1 at the end of this section as well as Bid documents. For a complete listing of all analytical findings for asbestos, refer to the survey report titled “GOGA 318662 Stinson Beach hazmat Survey Report”. This report can be provided upon request.

1.2 DEFINITIONS

1.2.1 Amended Water

Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter.

1.2.2 Asbestos-Containing Material (ACM)

Any materials containing more than one percent asbestos.

1.2.3 Authorized Person

Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

1.2.4 Building Inspector

Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by 40 CFR 763, Subpart E, Appendix C, has EPA/State certification/license as a "Building Inspector".

1.2.5 Class I Asbestos Work

Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM.

1.2.6 Class II Asbestos Work

Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes but is not limited to, the removal of asbestos - containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.

1.2.7 Class III Asbestos Work

Activities defined by OSHA that involve repair and maintenance operations, where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.

1.2.8 Class IV Asbestos Work

Maintenance and custodial demolition activities during which employees contact but do not disturb ACM and activities to clean-up dust, waste and debris resulting from Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following demolition.

1.2.9 Clean Room

An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

1.2.10 Competent Person

In addition to the definition in 29 CFR 1926.32(f), a person who is capable of identifying existing asbestos hazards as defined in 29 CFR 1926.1101, selecting the appropriate control strategy, has the authority to take prompt corrective measures to eliminate them and has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training; has EPA/State certification/license as a "Contractor/Supervisor".

1.2.11 Contractor/Supervisor

Individual who supervises asbestos abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; has EPA/State certification as a "Contractor/Supervisor".

1.2.12 Critical Barrier

One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.

1.2.13 Decontamination Area

An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

1.2.14 Demolition

The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

1.2.15 Disposal Bag

A 6-mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926.1101, used for transporting asbestos waste from containment to disposal site.

1.2.16 Disturbance

Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in 1 standard sized glovebag or waste bag, not larger than 60 inches in length and width in order to access a building component.

1.2.17 Equipment Room or Area

An area adjacent to the regulated area used for the decontamination of employees and their equipment.

1.2.18 Fiber

A fibrous particulate, 5 micrometers or longer, with a length to width ratio of at least 3 to 1.

1.2.19 Friable ACM

A term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

1.2.20 Glovebag

Not more than a 60 by 60-inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

1.2.21 High-Efficiency Particulate Air (HEPA) Filter

A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

1.2.22 Intact

ACM which has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix. Removal of "intact" asphaltic, resinous, cementitious products does not render the ACM non-intact simply by being separated into smaller pieces.

1.2.23 Model Accreditation Plan (MAP)

USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763.

1.2.24 Negative Initial Exposure Assessment

A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).

1.2.25 NESHAP

National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61, Subpart M.

1.2.26 Nonfriable ACM

A NESHAP term defined in 40 CFR 61, Subpart M and EPA 340/1-90/018 meaning any material containing more than 1 percent asbestos that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

1.2.27 Nonfriable ACM (Category I)

A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos.

1.2.28 Nonfriable ACM (Category II)

A NESHAP term defined in 40 CFR 61, Subpart E and EPA 340/1-90/018 meaning any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos.

1.2.29 Permissible Exposure Limits (PELs)

1.2.29.1 PEL-Time Weighted Average(TWA)

Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8-hour time weighted average (TWA).

1.2.29.2 PEL-Excursion Limit

An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes.

1.2.30 Regulated Area

An OSHA term defined in 29 CFR 1926.1101 meaning an area established by the Contractor to demarcate areas where Class I, II, and III asbestos work is conducted; also any adjoining area where debris and waste from such asbestos work accumulate; and an area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the permissible exposure limit.

1.2.31 Removal

All operations where ACM is taken out or stripped from structures or substrates, and includes demolition operations.

1.2.32 Repair

Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM attached to structures or substrates.

1.2.33 Surfacing ACM

Asbestos-containing material which contains more than 1% asbestos and is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

1.2.34 Thermal System Insulation (TSI) ACM

ACM which contains more than 1% asbestos and is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain or water condensation.

1.2.35 Transite

A generic name for asbestos cement wallboard and pipe.

1.2.36 Worker

Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926.1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation if required by the OSHA Class of work to be performed or by the state where the work is to be performed.

1.3 SYSTEM DESCRIPTION

Remove all asbestos-containing materials (ACM) that will be impacted by the proposed renovation and at all areas that will be affected or impacted by the work on this Project. All asbestos material is to be disposed of as ACM waste. The Contractor shall provide all plant, labor, equipment and materials complete for performance of the Work in accordance with the Contract Documents. In the event of a release of hazardous substances, notify the Contracting Officer immediately.

All waste materials shall become the property of the Contractor and shall be transported, disposed of in accordance with applicable regulations and this specification section.

This section covers all operations in which asbestos-containing materials (ACM) are encountered. These procedures and equipment are required to protect workers and building occupants from airborne asbestos fibers and ACM dust and debris. Activities include OSHA Class I, and Class II work operations. This section also includes containment, storage, transportation and disposal of the generated ACM wastes. Submit Detailed Drawings in accordance with Client’s requirements and containing descriptions, and site layout to include worksite containment area(s), local exhaust systems locations, decontamination units and load-out units, other temporary waste storage facility, access tunnels, location of temporary utilities (electrical, water, sewer) and boundaries of each regulated area.

1.3.1 Abatement Work Tasks

The specific ACM to be abated is identified in Table 02 82 14 - 1 at the end of this section and in the Bid documents.

1.3.2 Unexpected Discovery of Asbestos

For any previously untested building components suspected to contain asbestos and located in areas impacted by the work, notify the Contracting Officer (CO) who will have the option of ordering bulk samples to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM Methodology. Any additional components identified as ACM that have been approved by the CO for removal shall be removed and will be paid for by an equitable

adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course and is EPA/State certified/licensed as a "Building Inspector", to be appointed by the CO.

1.3.2.1 Bulk Sampling of Asphalt

It will be Contractor's responsibility to collect appropriate number of bulk samples of all homogeneous asphalt materials around the property and submit for appropriate asbestos analysis prior to start of abatement activities.

1.4 SUBMITTALS

1.4.1 Pre-construction Submittal

a. Detailed Abatement Drawings
b. Product Data
   - Safety Data Sheets for all materials
c. Encapsulants/Amended Water
d. Respiratory Protection Program
e. Cleanup and Disposal licenses
f. Qualifications
g. Training Program
h. Licenses, Permits and Notifications
i. Asbestos Hazard Abatement Plan (AHAP) and Site-Specific and Task-Specific Health and Safety Plan

1.4.2 During-construction Submittals

a. Area Air Sampling Results
b. Pressure Differential Recordings for Local Exhaust System
c. Clearance Sampling Results
d. Exposure Assessment and Personal Air Monitoring

1.4.3 Closeout Submittals

a. Final Notifications
b. Respirator Program Records
c. Inspection Results Final Report
d. Final Post-abatement Report
   - Summary of all activities
   - Record of all activities, logs, forms
   - Waste Tracking forms/manifests
   - All Personal and Area air monitoring results
   - All Firm and personnel licenses and certifications
   - All Laboratory certifications
   - All other information pertinent to abatement project

1.5 QUALITY ASSURANCE

In addition to detailed requirements of this specification, work performed under this contract shall comply with all applicable federal, state, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. Matters of interpretation of standards shall be submitted to the Contracting Officer for resolution before starting work. Where the

requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5.1 Written Qualifications and Organization Report

Submit a written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Designated IH; independent testing laboratory; all subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. Include in the report an organization chart showing the Contractor's staff organization chain of command and reporting relationship with all subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all subcontractors to be used. Include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926.1101, 40 CFR 61, Subpart M, and the federal, state and local requirements for those asbestos abatement activities that they will be involved in."

1.5.2 Specific Requirements

Federal Occupational Safety and Health Administrations (OSHA) regulations, locally enforced by CAL/OSHA, define ACM as substances that contain greater than 1% asbestos. Cal/OSHA also mandates special training, medical exams, personal protective equipment and record keeping for employees working with ACM. If a material contains less than 1% asbestos but more than 0.1% asbestos, the material may be disposed of as non-ACM, but the Cal/OSHA requirements would still have to be followed regarding workers' protection and Contractor licensing.

Cal-OSHA regulations 1529 (Asbestos in Construction) and 5208 (General Industry Asbestos Standard), the term “asbestos” is not defined by a specific concentration and thus means asbestos in any amount. This means the requirements of 1529 and 5208 would apply. This can include the following:

a. Proper training as required in Applicable regulations which include California Code of Regulations, Title 8, Section 1529 (Asbestos in Construction), Section 5208 (General Industry Asbestos Standard), as well as other regulations including Section 3203 (Injury and Illness Prevention) and 5194 (Hazard Communication)
b. Report of Carcinogen use with DOSH
c. Hazard communication to employees
d. In instances where the airborne asbestos concentrations have exceeded or are likely to exceed the PEL (Permissible Exposure Limit), employees would be provided with respirators and an employer would institute a respiratory protection program. As a result of this, a medical surveillance program would also need to be implemented by the employer prior to employees wearing respirators.
e. Adhering to work practices outlined in Cal-OSHA, including regulated areas, prohibitive access to these areas, safe work practices, and wet methods.

Asbestos abatement involving more than one hundred square feet (>100 SF) of asbestos-containing material (>0.1%) must be completed by a registered Abatement Contractor per the California Business & Professions Code (8 CCR Sections 341.6-9).

Designate in writing, personnel meeting the following qualifications:

a. Asbestos Abatement Contractor: Certified/licensed by EPA and California where work occurs to perform asbestos-related activities.

b. Designated Competent Person: Qualified in accordance with 29 CFR 1926.32 and 29 CFR 1926.1101, has EPA MAP "Contractor/Supervisor" training accreditation, has EPA certification/license as a "Contractor/Supervisor" and is experienced in the administration and supervision of asbestos abatement projects, including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite, etc. The Designated Competent Person shall be responsible for compliance with applicable federal, state and local requirements, the Contractor's Site-Specific and Task-Specific Health and Safety Plan (HASP) and Asbestos Hazard Abatement Plan (AHAP). Submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training, EPA certification/license with the employee "Certificate of Worker Acknowledgment". Submit evidence that this person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA competent person requirements. The Designated Competent Person shall be onsite at all times during the conduct of this project.

c. Project and Other Supervisors: Have EPA MAP "Contractor/Supervisor" training accreditation. Submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training, EPA certification/license with the employee "Certificate of Worker Acknowledgment". Also submit evidence that the Project Supervisor has a minimum of 2 years of on-the-job asbestos abatement experience relevant to project supervisor responsibilities and the other supervisors have a minimum of 2 years on-the-job asbestos abatement experience commensurate with the responsibilities they will have on this project.

d. Designated Industrial Hygienist: Resume for the Industrial Hygienist (IH) selected to prepare the Contractor's AHAP, prepare and perform training, direct air monitoring and assist the Contractor's Competent Person in implementing and ensuring that safety and health requirements are complied with during the performance of all required work. The Designated IH shall be a person who is board certified in the practice of industrial hygiene as determined and documented by the American Board of Industrial Hygiene (ABIH), has EPA MAP "Contractor/Supervisor" training accreditation, has EPA certification/license, and has a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities. Submit the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training and EPA certification/license with the employee "Certificate of Worker Acknowledgment". The Designated IH shall be completely independent from the Contractor according to federal, state, or local regulations; that is, shall not be a Contractor's employee or be an employee or principal of a firm in a business relationship with the Contractor negating such independent status. A copy of the Designated IH's current valid ABIH certification shall be included. The Designated IH shall visit the site at least twice per month for the duration of asbestos activities and shall be available for emergencies. In addition, submit resumes of additional IH's and industrial hygiene technicians who will be assisting the designated IH in performing onsite tasks. IHs and IHTs supporting the designated IH shall have a minimum of 2 years of practical onsite asbestos abatement experience. Indicate the formal reporting relationship between the Designated IH and the support IHs and HTs, the Designated Competent Person, and the Contractor.

e. Asbestos Abatement Workers: Meet the requirements contained in 29 CFR 1926.1101, 40 CFR 61, Subpart M, and other applicable federal, state and local requirements. Worker training

documentation shall be provided as required on the "Certificate of Workers Acknowledgment". Training documentation is required for each employee who will perform OSHA Class I, Class II, Class III, or Class IV asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment", to be completed for each employee in the same format and containing the same information as the example certificate at the end of this section. Training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached.

f. Physician: Resume of the physician who will or has performed the medical examinations and evaluations of the persons who will conduct the asbestos abatement work tasks. The physician shall be currently licensed by the state where the workers will be or have been examined, have expertise in pneumoconiosis and shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1926.1101. The physician shall be familiar with the site's hazards and the scope of this project.

g. Independent Testing Laboratory: identify the independent testing laboratory selected to perform the sample analyses and report the results. The testing laboratory shall be completely independent from the Contractor as recognized by federal, state or local regulations. Written verification of the following criteria, signed by the testing laboratory principal and the Contractor, shall be submitted:

1) Phase contrast microscopy (PCM): The laboratory is fully equipped and proficient in conducting PCM of airborne samples using the methods specified by 29 CFR 1926.1101, OSHA method ID-160, the most current version of NIOSH 94-113 Method 7400 as shown in Table 2 at the end of this Section. The laboratory shall be currently judged proficient (classified as acceptable) in counting airborne asbestos samples by PCM by successful participation in each of the last 4 rounds in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or by participating in the AIHA PAT Program, and being judged proficient in counting samples.

2) Polarized light microscopy (PLM): The laboratory is fully equipped and proficient in conducting PLM analyses of suspect ACM bulk samples in accordance with 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for bulk asbestos analysis and will use analysts with demonstrated proficiency to conduct PLM analyses.

3) Transmission electron microscopy (TEM): The laboratory is fully equipped and proficient in conducting TEM analysis of airborne samples using the mandatory method specified by 40 CFR 763, Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for airborne sample analysis of asbestos by TEM; the laboratory will use analysts with demonstrated proficiency under NVLAP.

4) PCM/TEM: The laboratory is fully equipped and each analyst is proficient in conducting PCM and TEM analysis of airborne samples using NIOSH 94-113 Method 7400 PCM and NIOSH 94-113 Method 7402 (TEM confirmation of asbestos content of PCM results) from the same filter.

h. Disposal Facility, Transporter: Written evidence that the landfill to be used is approved for asbestos disposal by the USEPA. Copies of signed agreements between the Contractor (including subcontractors and transporters) and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste shall be provided. The Contractor and transporters shall meet the DOT requirements of 49 CFR 171, 49 CFR 172, and 49 CFR 173 as well as registration requirements of 49 CFR 107 and other applicable state or local requirements. The disposal facility shall meet the requirements of 40 CFR 61, Sections 154 or .155, as required in 40 CFR 61 150(b), and other applicable state or local requirements.

1.5.3 Federal, State or Local Citations on Previous Projects

The Contractor and all subcontractors shall submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company shall be provided.

1.5.4 Pre-demolition Conference

The Contractor and the Contractor's Designated Competent Person, Project Supervisor, and Designated IH shall meet with the Contracting Officer (CO) prior to beginning work at a safety pre-demolition conference to discuss the details of the Contractor's submitted APP to include the AHAP and Activity Hazard Analysis (AHA) appendices. Deficiencies in the APP will be discussed. Onsite work shall not begin until the APP has been accepted.

1.6 SAFETY

Prepare a written comprehensive Site-Specific and Task-Specific Health and Safety Plan (HASP) at least 30 days prior to the pre-demolition conference. The HASP shall incorporate an Asbestos Hazard Abatement Plan (AHAP)

1.6.1 Asbestos Hazard Abatement Plan

The AHAP shall include, but not be limited to, the following:

a. The personal protective equipment to be used;
b. The location and description of regulated areas including clean and dirty areas, access tunnels, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);
c. Initial exposure assessment in accordance with 29 CFR 1926.1101;
d. Level of supervision;
e. Method of notification of other employers at the worksite;
f. Abatement method to include containment and control procedures;
g. Interface of trades;
h. Sequencing of asbestos related work;
i. Storage and disposal procedures and plan;
j. Type of wetting agent and asbestos encapsulant;
k. Location of local exhaust equipment;
l. Air monitoring methods (personal, environmental and clearance);
m. Bulk sampling and analytical methods;
n. A detailed description of the method to be employed in order to control the spread of ACM wastes and airborne fiber;
o. Fire and medical emergency response procedures;

p. The security procedures to be used for all regulated areas;
q. Method of providing water and power to the work areas.

1.6.2 Activity Hazard Analyses Appendix

Section not used.

1.6.3 Local Exhaust System

Local exhaust units shall conform to AIHA Z9.2 and 29 CFR 1926.1101. Filters on local exhaust system equipment shall conform to AIHA Z9.2 and UL 586. Filter shall be UL labeled. Submit pressure differential recordings and Manufacturer's certifications showing compliance with AIHA Z9.2 for:

a. Vacuums
b. Water filtration equipment
c. Ventilation equipment
d. Other equipment required to contain airborne asbestos fibers

1.6.2 SECURITY

Fenced and locked security area shall be provided for each regulated area. A logbook shall be kept documenting entry into and out of the regulated area. Entry into regulated areas shall only be by personnel authorized by the Contractor and the CO. Personnel authorized to enter regulated areas shall be trained, medically evaluated, and wear the required personal protective equipment.

1.6.2.1 Regulated Areas

All Class I, II, and III asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

1.6.2.2 Warning Signs and Tape

Warning signs and tape printed bilingually in English and the language most used by abatement personnel shall be provided at the regulated boundaries and entrances to regulated areas. Signs shall be located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs displaying the following legend in the lower panel:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

1.6.2.3 Warning Labels

Warning labels shall be affixed to all asbestos disposal containers, asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable. Warning labels should display the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS

1.7 LICENSES, PERMITS, NOTIFICATIONS

1.7.1 Licenses, Permits and Notifications

Obtain necessary licenses, permits and notifications in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify the California Division of Occupational Safety and Health (Cal/OSHA), at the nearest Cal/OSHA district office, and the CO in writing, at least 24 hours in advance of the commencement of work impacting 160 sq. ft. or 260 lin. ft. of ACM, submitting the Temporary Worksite Notification (Report of Regulated Carcinogen Use including Asbestos Carcinogen Report of Use, including Asbestos-Related Work) in accordance with 8 CCR 1529, 8 CCR 1532.1, and 8 CCR 5203.

The Contractor shall also notify the Bay Area Air Quality Management District (BAAQMD), and the CO in writing, at least 10 days prior to the commencement of work involving 100 sq. ft. of friable ACM, in accordance with 40 CFR 61, Subpart M, and BAAQMD Regulation 11, Rule 2, to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents. Notification shall be by the BAAQMD Online Asbestos Notification System (https://www.baaqmd.gov/permits/asbestos). Furnish copies of the receipts to the CO, in writing, prior to the commencement of work. All required notifications shall be posted on site during all asbestos-related work. Local fire department shall be notified 3 days before fireproofing material is removed from a building and the notice shall specify whether or not the material contains asbestos (if applicable). The Contractor is responsible for the associated fees/costs for licenses, permits, and notifications.

1.7.2 Local Air Quality Board

Written notification is required to the Bay Area Air Quality Management District (BAAQMD) at least 10 days prior to beginning any work on 100 square feet (sq. ft.) or more of friable asbestos-containing materials. The EPA also enforces this requirement.

1.7.3 Cal-OSHA

Written notification on (their form) to the California Occupational Safety and Health Administration (Cal-OSHA) is required by Cal-OSHA Asbestos Regulations (Title 8, Section 341.9) at least 24 hours prior to beginning any work on asbestos-containing materials**.**

Prior to the abatement, all employees, contractors, or other parties who may be affected by the abatement must be advised in writing of activities pursuant to Cal-OSHA Asbestos Regulations (Title 8, Section 1529, Subpart K).

1.8. MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance requirements shall conform to 29 CFR 1926.1101. Asbestos workers shall be enrolled in a medical surveillance program that meets 29 CFR 1926.1101 (m) requirements and other pertinent state or local requirements. This requirement shall have been satisfied within the last 12 months. Submit required medical certification and the Physician’s written opinion.

1.8.1 Respiratory Protection Program

The Contractor's Designated IH shall establish in writing, and implement a respiratory protection program in accordance with 29 CFR 1926.1101 and 29 CFR 1910.134. The Contractor's Designated IH shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations.

1.8.2 Respiratory Fit Testing

The Contractor's Designated IH shall conduct a qualitative or quantitative fit test conforming to Appendix A of 29 CFR 1910.134 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test shall be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test shall be performed. Functional fit checks shall be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.8.3 Respirator Selection and Use Requirements

Provide respirators, and ensure that they are used as required by 29 CFR 1926.1101 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators shall be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. For air-purifying respirators, the particulate filter shall be high-efficiency particulate air (HEPA)/ (N-, R-, P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type shall be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered.

1.8.4 Personal Protective Equipment

Three complete sets of personal protective equipment shall be made available to the CO and authorized visitors for entry to the regulated area. The CO and authorized visitors shall be provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of personal protective equipment and the site safety and health requirements. Provide workers with personal protective clothing and equipment and ensure that it is worn properly. The Designated IH and Designated Competent Person shall select and approve all the required personal protective clothing and equipment.

1.8.5 Whole Body Protection

Personnel exposed to or having the potential to be exposed to airborne concentrations of asbestos that exceed the PELs, or for all OSHA Classes of work for which a required negative exposure assessment is not produced, shall be provided with whole body protection and such protection shall be worn properly. Disposable whole-body protection shall be disposed of as asbestos contaminated waste upon exiting from the regulated area. Reusable whole-body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the regulated area or be properly laundered in accordance with 29 CFR 1926.1101. The Contractor's Designated Competent Person, in consultation with the Designated IH, has the authority to take immediate action to upgrade or downgrade whole body protection when there is an immediate danger to the health and safety of the wearer.

1.8.5.1 Coveralls

Disposable-impermeable coveralls with a zipper front shall be provided. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles.

1.8.5.2 Gloves

Gloves shall be provided to protect the hands where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.).

1.8.5.3 Foot Coverings

Cloth socks shall be provided and worn next to the skin. Footwear, as required by OSHA and EM 385-1-1, that is appropriate for safety and health hazards in the area shall be worn. Reusable

footwear removed from the regulated area shall be thoroughly decontaminated or disposed of as ACM waste.

1.8.5.4 Head Covering

Hood type disposable head covering shall be provided. In addition, protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the regulated area after being thoroughly decontaminated.

1.8.5.5 Protective Eye Wear

Eye protection shall be provided, when operations present a potential eye injury hazard, and shall meet the requirements of ANSI/ISEA Z87.1.

1.9 HYGIENE

Establish a decontamination area for the decontamination of employees, material and equipment. Ensure that employees enter and exit the regulated area through the decontamination area.

1.9.1 3-Stage Decontamination Area

A temporary negative pressure decontamination unit that is adjacent must be provided. The decontamination unit shall have an equipment room and a clean room separated by a shower that complies with 29 CFR 1910.141, unless the Contractor can demonstrate that such facilities are not feasible. Equipment and surfaces of containers filled with ACM shall be cleaned prior to removing them from the equipment room or area. Two separate lockers shall be provided for each asbestos worker, one in the equipment room and one in the clean room. Provide a minimum of 1 shower for every 10 workers (including supervisor), but not less than 2 showers. Wastewater shall be collected and filtered to remove asbestos contamination. Filters and residue shall be disposed of as asbestos contaminated material. Filtered water may be discharged to the sanitary sewer system if approved in advance by CO. Wastewater filters shall be installed in series with the first stage pore size of 20 microns and the second stage pore size of 5 microns. The floor of the decontamination unit's clean room shall be kept dry and clean at all times. Proper housekeeping and hygiene requirements shall be maintained. Soap and towels shall be provided for showering, washing and drying. Any cloth towels provided shall be disposed of as ACM waste or shall be laundered in accordance with 29 CFR 1926.1101.

1.9.2 Load-Out Unit

A temporary load-out unit (storage area) that is adjacent and connected to the regulated area shall be provided. The load-out unit shall be large enough to accommodate bags of waste from an entire shift.

1.9.3 Single Stage Decontamination Area

A decontamination area (equipment room/area) shall be provided for Class I work involving less than 25 feet or 10 square feet of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment. The equipment room or area shall be adjacent to the regulated area for the decontamination of employees, material, and their equipment which could be contaminated with asbestos. The area shall be covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area.

1.9.4 Decontamination Area Exit Procedures

Ensure that the following procedures are followed:

a. Before leaving the regulated area, remove all gross contamination and debris from work clothing using a HEPA vacuum.
b. Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers for disposal and/or laundering.
c. Employees shall not remove their respirators until showering.
d. Employees shall shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, ensure that employees engaged in Class I asbestos jobs:
    a. Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or
    b. Remove their contaminated work suits in the equipment room, without cleaning work suits, and proceed to a shower that is not adjacent to the work area.

1.9.5 Smoking

Smoking on project site is confined to the designated area, to be determined by CO and General Contractor.

1.10 TRAINING PROGRAM

Establish and submit a training program as specified by EPA MAP, training requirements at 40 CFR 763, the State of California regulations, OSHA requirements at 29 CFR 1926.1101 (k)(9). Contractor employees shall complete the required training for the type of work they are to perform and such training shall be documented and provided to the CO.

a. Class I and II operations 32 hours Asbestos Worker Training
b. Class II generic removal 8-hour Asbestos Worker Training
c. Prior to commencement of work the Contractor's Designated IH and Competent Person shall instruct each worker about:
    i. The hazards and health effects of the specific types of ACM to be abated; and
    ii. The content and requirements of the Contractor's APP to include the AHAP and AHAs and site-specific safety and health precautions.

PART 2 – PRODUCTS

2.1 ENCAPSULANTS

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent. Submit certificates stating that encapsulants meet the applicable specified performance requirements.

2.2 ENCASEMENT PRODUCTS

Encasement shall consist of primary cellular polymer coat, polymer finish coat, and any other finish coat as approved by the CO.

2.3 EXPENDABLE SUPPLIES

2.3.1 Glovebag

Glovebags shall be provided as described in 29 CFR 1926.1101. The glovebag assembly shall be 6 mil thick plastic, prefabricated and seamless at the bottom with preprinted OSHA warning label.

2.3.2 Duct Tape

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container.

2.3.3 Disposal Containers

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers shall be provided for ACM wastes as required by 29 CFR 1926.1101. Disposal containers can be in the form of:

a. Disposal Bags

b. Fiberboard Drums

c. Cardboard Boxes

2.3.4 Sheet Plastic

Sheet plastic shall be polyethylene of 6 mil minimum thickness and shall be provided in the largest sheet size necessary to minimize seams. Film shall be frosted and conform to ASTM D 4397, except as specified below:

2.3.4.1 Flame Resistant

Where a potential for fire exists, flame-resistant sheets shall be provided. Film shall be frosted and shall conform to the requirements of NFPA 701.

2.3.4.2 Reinforced

Reinforced sheets shall be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

2.3.5 Mastic Removing Solvent

Mastic removing solvent shall be nonflammable and shall not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite shall have a flash point greater than 140 degrees F.

2.3.6 Leak-tight Wrapping

Two layers of 6 mil minimum thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

2.3.7 Viewing Inspection Window

Where feasible, a minimum of 1 clear, 1/8-inch-thick, acrylic sheet, 18 by 24 inches, shall be installed as a viewing inspection window at eye level on a wall in each containment enclosure. The windows shall be sealed leak-tight with industrial grade duct tape.

2.3.8 Wetting Agents

Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS above.

2.3.9 Strippable Coating

Strippable coating in aerosol cans shall be used to adhere to surfaces and to be removed cleanly by stripping, at the completion of work.

2.4 EQUIPMENT

2.4.1 Scales

Section not used.

2.4.2 Tools

Vacuums shall be equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

2.4.3 Rental Equipment

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment.

2.4.4 Air Monitoring Equipment (Personal OSHA Monitoring)

The Contractor's Designated IH shall approve air monitoring equipment. The equipment shall include, but shall not be limited to:

a. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

b. Single use standard 25 mm diameter cassette, open face, 0.8-micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands for personal air sampling.

c. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

2.4.5 Air Monitoring Equipment (Area)

Area air monitoring shall be conducted by an independent environmental consultant subcontracted by the General Contractor who reports directly to the Contracting Officer.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

Asbestos abatement work is described in the contract documents (abatement drawings). Use the engineering controls and work practices required in 29 CFR 1926.1101(g) and State regulations in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and

equipment. Do not permit eating, smoking, drinking, chewing or applying cosmetics in the regulated area. Personnel of other trades shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's APP are complied with. Power to the regulated area shall be locked-out and tagged in accordance with 29 CFR 1910.147, and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. Stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. Correct the condition to the satisfaction of the CO, including visual inspection and air sampling. Work shall resume only upon notification by the CO. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

Perform asbestos abatement without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, it shall be restored to its original condition or decontaminated at no expense to the Government. When spills occur, work shall stop in all affected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's Designated IH and the CO, work shall proceed.

3.3 OBJECTS

3.3.1 Removal of Mobile Objects

The Contractor will be responsible for removal and disposal of any remaining Furniture, and equipment from the area of work before work begins.

3.3.2 Stationary Objects

The Contractor will be responsible for removal of any remaining stationary objects, furniture, and equipment.

3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS

Building ventilation system supply and return air ducts in a regulated area (if any) shall be shut down and isolated by lockable switch or other positive means in accordance with 29 CFR 1910.147.2 layers of polyethylene. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape.

3.5 PRECLEANING

Surfaces shall be cleaned by HEPA vacuum and adequately wet wiped prior to establishment of containment.

3.6 METHODS OF COMPLIANCE

3.6.1 Mandated Practices

The specific abatement techniques and items identified shall be detailed in the Contractor's AHAP. Use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

a. Vacuum cleaners equipped with HEPA filters.

b. Wet methods or wetting agents except where it can be demonstrated that the use of wet methods is unfeasible due to the creation of electrical hazards, equipment malfunction, and in roofing.

c. Prompt clean-up and disposal.

d. Inspection and repair of polyethylene.

e. Cleaning of equipment and surfaces of containers prior to removing them from the equipment room or area.

3.6.2 Control Methods

Use the following control methods:

a. Local exhaust ventilation equipped with HEPA filter;

b. Enclosure or isolation of processes producing asbestos dust;

c. Where the feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, use them to reduce employee exposure to the lowest levels attainable and shall supplement them by the use of respiratory protection.

d. Dispersed Oil Particulate Sampling

3.6.3 Unacceptable Practices

The following work practices shall not be used:

a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

b. Compressed air used to remove asbestos containing materials, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

c. Dry sweeping, shoveling, or other dry clean up.

d. Employee rotation as a means of reducing employee exposure to asbestos.

3.6.4 Class I Work Procedures

In addition to requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

a. A Competent Person shall supervise the installation and operation of the control methods.

b. For jobs involving the removal of more than 25 feet or 10 square feet of TSI or surfacing material, place critical barriers over all openings to the regulated area.

c. HVAC systems shall be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.

d. Impermeable dropcloths (6 mil or greater thickness) shall be placed on surfaces beneath all removal activity.

e. Where a negative exposure assessment has not been provided or where exposure monitoring shows the PEL was exceeded, the regulated area shall be ventilated with a HEPA unit and employees must use PPE.

3.6.5 Specific Control Methods for Class I Work

Use Class I work procedures, control methods and removal methods for the

following ACM:
a. Spray Applied Fireproofing
b. Gypsum Wallboard and Joint Compound
c. Thermal System Insulation and Mudded Pipe Fittings
d. Plaster and Textured Ceilings and Walls
e. Vermiculite

3.6.5.1 Negative Pressure Enclosure (NPE) System

The system shall provide at least 4 air changes per hour inside the containment. The local exhaust unit equipment shall be operated 24 hours per day until the containment is removed. The NPE shall be smoke tested for leaks at the beginning of each shift and be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential shall be monitored continuously, 24 hours per day, with an automatic manometric recording instrument and Records shall be provided daily on the same day collected to the CO. The CO shall be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system shall not be used as the local exhaust system for the regulated area.

The NPE shall terminate outdoors unless an alternate arrangement is allowed by the CO. All filters used shall be new at the beginning of the project and shall be periodically changed as necessary and disposed of as ACM waste.

3.6.5.2 Glovebag Systems

Section not used

3.6.5.3 Mini-Enclosures (Tent)

Section not used

3.6.5.4 Wrap and Cut Operation

Prior to cutting pipe or conduit, the asbestos-containing insulation/material shall be wrapped with polyethylene and securely sealed with duct tape to prevent asbestos becoming airborne as a result of the cutting process. The following steps shall be taken: install glovebag, strip back sections to be cut 6 inches from point of cut, and cut pipe into manageable sections.

3.6.6 Class II Work

In addition to the requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

a. A Competent Person shall supervise the work.

b. For indoor work, critical barriers shall be placed over all openings to the regulated area.

c. Impermeable dropcloths shall be placed on surfaces beneath all removal activity.

3.6.7 Specific Control Methods for Class II Work

3.6.7.1 Vinyl and Asphalt Flooring Materials

When removing ACM vinyl and asphalt flooring materials and mastics use practices as follows. Resilient sheeting shall be removed by adequately wet methods. Tiles shall be removed intact (if possible). Flooring or its backing shall not be sanded. Scraping of residual adhesive/mastic shall be performed using wet methods. Mechanical chipping is prohibited unless performed in a negative

pressure enclosure. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) to clean floors.

3.6.7.1 Roofing Material (and other Exterior Non-friable Materials such as Caulks and Glazing)

When removing roofing materials which contain ACM as described in 29 CFR 1926.1101(g)(8)(ii), the Contractor shall use the following practices. Roofing material shall be removed in an intact state. Wet methods shall be used to remove roofing materials that are not intact, or that will be rendered not intact during removal, unless such wet methods are not feasible or will create safety hazards. When removing built-up roofs, with asbestos-containing roofing felts and an aggregate surface, using a power roof cutter, all dust resulting from the cutting operations shall be collected by a HEPA dust collector, or shall be HEPA vacuumed by vacuuming along the cut line. Asbestos-containing roofing material shall not be dropped or thrown to the ground, but shall be lowered to the ground via covered, dust-tight chute, crane, hoist or other method approved by the CO. Any ACM that is not intact shall be lowered to the ground as soon as practicable, but not later than the end of the work shift. While the material remains on the roof it shall be kept wet or placed in an impermeable waste bag or wrapped in plastic sheeting. Intact ACM shall be lowered to the ground as soon as practicable, but not later than the end of the work shift. Unwrapped material shall be transferred to a closed receptacle. Critical barriers shall be placed over roof level heating and ventilation air intakes.

3.6.7.2 Cementitious Siding and Shingles or Transite Panels

Section not used.

3.6.7.3 Gaskets and other Non-friable Items (Electrical Panel Components)

Gaskets/components shall be thoroughly wetted with amended water prior to removal and immediately placed in a disposal container. If a gasket is visibly deteriorated and unlikely to be removed intact, removal shall be undertaken within a glovebag. Any scraping to remove residue shall be performed wet.

3.6.8 Specific Control Methods for Class III Work

Section not used.

3.6.9 Specific Control Methods for Class IV Work

Section not used.

3.6.10 Methods for Asphaltic Wrap

Section not used.

3.6.11 Abatement of Asbestos Contaminated Soil

Section not used.

3.6.12 Enclosure of ACM

Section does not apply.

3.6.13 Encapsulation of ACM

Section does not apply.

3.6.14 Combined Encapsulation of Acoustical Wall and Ceiling Plaster

Section does not apply.

3.6.15 Sealing Contaminated Items Designated for Disposal

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3.7 FINAL CLEANING AND VISUAL INSPECTION

After completion of all asbestos removal work and the gross amounts of asbestos have been removed from every surface, any remaining visible accumulations of asbestos shall be collected. For all classes of indoor asbestos abatement projects, a final cleaning shall be performed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the cleaning, conduct a visual pre-inspection of the cleaned area in preparation for a final inspection before final air clearance monitoring. The Contractor and the CO shall conduct a final visual inspection of the cleaned regulated area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection. If the CO rejects the clean regulated area as not meeting final cleaning requirements, reclean as necessary and have a follow-on inspection conducted with the CO. Recleaning and follow-up reinspection shall be at the Contractor's expense.

3.8 LOCKDOWN

Prior to removal of plastic barriers and after final visual inspection, a (lockdown) encapsulant shall be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.9 EXPOSURE ASSESSMENT AND AIR MONITORING

3.9.1 General Requirements

a. Exposure assessment, air monitoring and analysis of airborne concentration of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101, and the Contractor's air monitoring plan. Results of breathing zone samples shall be posted at the job site and made available to the CO. Submit all documentation regarding initial exposure assessments, negative exposure assessments, and air-monitoring results.

b. Worker Exposure.

1) The Contractor's Designated IH shall collect samples representative of the exposure of each employee who is assigned to work within a regulated area. Breathing zone samples shall be taken for at least 25 percent of the workers in each shift, or a minimum of 2, whichever is greater. Air monitoring results at the 95 percent confidence level shall be calculated as shown in Table 1 at the end of this section.

2) The Contractor shall submit the samples to an independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of air samples using the methods prescribed in 29 CFR 1926.1101, to include NIOSH 94-113 Method 7400. The results of the sample analysis shall be available to CO and workers within 24 hours of end of each shift.

3) Workers shall not be exposed to an airborne fiber concentration in excess of 1.0 f/cc, as averaged over a sampling period of 30 minutes. Should a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur inside a regulated work area, stop work immediately, notify the CO, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Do not restart work until authorized by the CO.

c. Environmental Exposure

1) All environmental air monitoring shall be performed by an independent firm hired by the Contractor.

2) Environmental and final clearance air monitoring shall be performed using NIOSH 94-113 Method 7400 (PCM) with optional confirmation of results by EPA TEM.

3) For environmental and final clearance, air monitoring shall be conducted at a sufficient velocity and duration to establish the limit of detection of the method used at 0.005 f/cc.

4) When confirming asbestos fiber concentrations (asbestos f/cc) from environmental and final clearance samples, use TEM in accordance with NIOSH 94-113 Method 7402. When such confirmation is conducted, it shall be from the same sample filter used for the NIOSH 94-113 Method 7400 PCM analysis. All confirmation of asbestos fiber concentrations, using NIOSH 94-113 Method 7402, shall be at the Contractor's expense.

5) Maintain a fiber concentration inside a regulated area less than or equal to 0.1 f/cc expressed as an 8-hour, time-weighted average (TWA) during the conduct of the asbestos abatement.

6) At the discretion of the Contracting Officer, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. Should an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA occur inside a regulated work area, stop work immediately, notify the Contracting Officer, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the CO.

3.9.2 Initial Exposure Assessment

The Contractor's Designated IH shall conduct an exposure assessment immediately before or at the initiation of an asbestos abatement operation to ascertain expected exposures during that operation. The assessment shall be completed in time to comply with the requirements, which are triggered by exposure data or the lack of a negative exposure assessment, and to provide information necessary to assure that all control systems planned are appropriate for that operation. The assessment shall take into consideration both the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the Contractor which indicate the levels of airborne asbestos likely to be encountered on the job. For Class I asbestos work, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in excess of PELs, or otherwise makes a negative exposure assessment, presume that employees are exposed in excess of the PEL-TWA and PEL-Excursion Limit.

3.9.3 Negative Exposure Assessment

Provide a negative exposure assessment for the specific asbestos job which will be performed within 30 days of the initiation of the project before starting work with potential exposure and conform to the following criteria:

a. Objective Data: Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release

airborne fibers in concentrations exceeding the PEL-TWA and PEL-Excursion Limit under those work conditions having the greatest potential for releasing asbestos.

b. Prior Asbestos Jobs: Where the Contractor has monitored prior asbestos jobs for the PEL and the PEL-Excursion Limit within 12 months of the current job, the monitoring and analysis were performed in compliance with asbestos standard in effect; the data were obtained during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the Contractor's current operations; the operations were conducted by employees whose training and experience are no more extensive than that of employees performing the current job; and these data show that under the conditions prevailing and which will prevail in the current workplace, there is a high degree of certainty that the monitoring covered exposure from employee exposures will not exceed the PEL-TWA and PEL-Excursion Limit.

c. Initial Exposure Monitoring: The results of initial exposure monitoring of the current job, made from breathing zone air samples that are representative of the 8-hour PEL-TWA and 30-minute short-term exposures of each employee. The monitoring covered exposure from operations which are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

3.9.4 Independent Environmental Monitoring

The Contractor shall retain an independent air monitoring firm to perform pre-abatement, during abatement, final clearance air monitoring. The air monitoring Contractor will be provided a copy of the contract that includes this abatement work. The abatement Contractor will provide the air monitoring Contractor with an up-to-date copy of the accepted AHAP, APP and pertinent detailed drawings. The air monitoring Contractor is required to comply with the abatement Contractor's safety and health requirements. The abatement Contractor will coordinate all onsite activities with the air monitoring Contractor, the CO, and other affected parties as directed by the CO. The abatement Contractor will provide the air monitoring Contractor with an up-to-date schedule of abatement Contractor work activities. The air monitoring Contractor will coordinate with the abatement Contractor and the COR during the performance of Government required air monitoring. The abatement Contractor is responsible for performing exposure assessment and personal air monitoring of abatement Contractor's work. The air monitoring Contractor is responsible for performing these tasks for its employee.

3.9.5 Preabatement Environmental Air Monitoring

Preabatement environmental air monitoring shall be established immediately prior to the masking and sealing operations for each regulated area to determine background concentrations before abatement work begins. As a minimum, preabatement air samples shall be collected using NIOSH 94-113 Method 7400, PCM at these locations: outside the building; inside the building, but outside the regulated area perimeter; and inside each regulated work area. At least 3 samples shall be collected within the regulated work areas on each floor and 3 samples outside of the regulated work areas on each floor. At least 2 samples shall be collected outside the building: at the exhaust of the HEPA unit; and downwind from the abatement site. The PCM samples shall be analyzed within 24 hours; and if any result in fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using NIOSH 94-113 Method 7402 (TEM).

3.9.6 Environmental Air Monitoring During Abatement

Until an exposure assessment is provided to the CO, environmental air monitoring shall be conducted at locations and frequencies that will accurately characterize any evolving airborne asbestos fiber concentrations. The assessment shall demonstrate that the product or material containing asbestos minerals, or the abatement involving such product or material, cannot release airborne asbestos fibers in concentrations exceeding 0.01 f/cc as a TWA under those work conditions having the greatest potential for releasing asbestos. The monitoring shall be at least once per shift at locations including, but not limited

to, close to the work inside a regulated area; preabatement sampling locations; outside entrances to a regulated area; close to glovebag operations; representative locations outside of the perimeter of a regulated area; inside clean room; and at the exhaust discharge point of local exhaust system ducted to the outside of a containment (if used). If the sampling outside regulated area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, work shall be stopped immediately, and the Contracting Officer notified. The condition causing the increase shall be corrected. Work shall not restart until authorized by the CO.

3.9.7 Final Clearance Air Monitoring

The IH will conduct final clearance air monitoring using aggressive air sampling techniques as defined in 40 CFR 763, Subpart E, Appendix A, Unit III, TEM Method B.7(d-f) and Table 3 of this section for all indoor asbestos abatement projects. Clearance air monitoring is not required for outside work or for soil cleanups.

3.9.7.1 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH 94-113 Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, shall be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) shall be confirmed from that same filter using NIOSH 94-113 Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning shall be repeated. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria shall be done.

3.9.7.2 Final Clearance Requirements, EPA TEM Method (if requested)

For EPA TEM sampling and analysis, using the EPA Method specified in 40 CFR 763, abatement inside the regulated area is considered complete when the arithmetic mean asbestos concentration of the 5 inside samples is less than or equal to 70 structures per square millimeter (70 S/mm). When the arithmetic mean is greater than 70 S/mm, the 3 blank samples shall be analyzed. If the 3 blank samples are greater than 70 S/mm, resampling shall be done. If less than 70 S/mm, the 5 outside samples shall be analyzed and a Z-test analysis performed. When the Z-test results are less than 1.65, the decontamination shall be considered complete. If the Z-test results are more than 1.65, the abatement is incomplete and cleaning shall be repeated. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria shall be done.

3.9.7.3 Air Clearance Failure

If clearance sampling results fail to meet the final clearance requirements, pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met or as otherwise directed by the CO.

3.9.8 Air-Monitoring Results and Documentation

Air sample fiber counting shall be completed and results provided within 24 hours (breathing zone samples), and before start of next shift environmental/clearance monitoring) after completion of a sampling period. The CO shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing laboratory principal. The air sampling results shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample:

a. Sampling and analytical method used;

b. Date sample collected;

c. Sample number;

d. Sample type: BZ = Breathing Zone (Personal), P = Preabatement, E= Environmental, C = Abatement Clearance;

e. Location/activity/name where sample collected;

f. Sampling pump manufacturer, model and serial number, beginning flow rate, end flow rate, average flow rate (L/min);

g. Calibration date, time, method, location, name of calibrator, signature;

h. Sample period (start time, stop time, elapsed time (minutes);

i. Total air volume sampled (liters);

j. Sample results (f/cc and S/mm square) if EPA methods are required for final clearance;

k. Laboratory name, location, analytical method, analyst, confidence level. In addition, the printed name and a signature and date block for the Industrial Hygienist who conducted the sampling and for the Industrial Hygienist who reviewed the daily air monitoring log verifying the accuracy of the information.

3.10 CLEARANCE CERTIFICATION

When asbestos abatement is complete, ACM waste is removed from the regulated areas, and final clean-up is completed, the CO will allow the warning signs and boundary warning tape to be removed. After final clean-up and acceptable airborne concentrations are attained, the Contractor, Air Monitoring Contractor representative and the CO shall visually inspect all surfaces within the containment for residual material or accumulated debris. Reclean all areas showing dust or residual materials. The CO will certify in writing that the area is safe before unrestricted entry is permitted.

3.11 CLEANUP AND DISPOSAL

3.11.1 Title to ACM Materials

ACM materials resulting from abatement work, except as specified otherwise, shall remain property of the government until they shall be disposed of as specified and in accordance with applicable federal, state and local regulations by the Contractor.

3.11.2 Collection and Disposal of Asbestos

All ACM waste shall be collected including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing and placed in leak-tight containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Waste within the containers shall be wetted in accordance with 40 CFR 61, Subpart M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 6 mils thick bags with approved warnings and DOT labeling pre-printed on the bags. The name of the waste generator and location at which the waste was generated shall be clearly indicated on the outside of each container. Care must be taken to prevent contamination of the transport vehicle. These precautions include lining the vehicle cargo area with plastic sheeting, and thorough cleaning of the cargo area after transport and unloading of asbestos waste is complete. Asbestos-containing waste shall be disposed of at an EPA, state and local approved asbestos landfill off Government property. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the CO. Procedure for hauling and

disposal shall comply with 40 CFR 61, Subpart M, state, regional, and local standards. Submit manufacturer's catalog data for all materials and equipment to be used, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of this specification. Safety Data Sheets for all chemicals to be used onsite in the same format as implemented in the Contractor's HAZARD COMMUNICATION PROGRAM. Data shall include, but shall not be limited to, the following items:

a. High Efficiency Filtered Air (HEPA) local exhaust equipment

b. Vacuum cleaning equipment

c. Pressure differential monitor for HEPA local exhaust equipment

d. Air monitoring equipment

e. Respirators

f. Personal protective clothing and equipment

g. Glovebags. Written manufacturer's proof that glovebags will not break down under expected temperatures and conditions.

h. Duct Tape

i. Disposal Containers

j. Sheet Plastic

k. Wetting Agent

l. Strippable Coating

m. Prefabricated Decontamination Unit

n. Safety Data Sheets (for all chemicals proposed)

3.11.3 Records

3.11.3.1 Asbestos Waste Shipment Records

Complete and provide the CO final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61, Subpart M and other required state waste manifest shipment records, within 3 days of delivery to the landfill. Each Waste Shipment Record shall be signed and dated by the Contractor, the waste transporter and disposal facility operator.

3.11.4 Disposal of Asbestos-Containing Waste Material

3.11.4.1 General

California Department of Toxic Substances Control (DTSC) classifies asbestos-containing material as hazardous waste if it is friable and contains one percent (1.0%) or more asbestos as hazardous waste. Because the United States Environmental Protection Agency (U.S. EPA) does not regulate asbestos as hazardous waste under the Resource Conservation and Recovery Act (RCRA), it is considered to be a “non-RCRA,” or “California-only” hazardous waste.

DTSC considers non-friable bulk asbestos-containing waste to be non-hazardous regardless of its asbestos content, so it is not subject to regulation under Title 22, Division 4.5, of the California Code of Regulations. Again, other regulatory agencies operating under separate authority have their own requirements or restrictions.

TABLE 1

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL (Reference: NIOSH 7400)

Fibers/cc (01.95 percent CL) = X + [(X) * (1.645) * (CV)] Where: X =

((E)(AC))/((V)(1000))

E = ((F/Nf) - (B/Nb))/Af

CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the Contracting Officer with documentation (Round Robin Program participation and results) that the laboratory's precision is better.

AC = Effective collection area of the filter in square millimeters

V = Air volume sampled in liters

E = Fiber density on the filter in fibers per square millimeter

F/Nf = Total fiber count per graticule field

B/Nb = Mean field blank count per graticule field Af = Graticule

field area in square millimeters TWA = C1/T1 + C2/T2 = Cn/Tn

Where: C = Concentration of contaminant

T = Time sampled.

TABLE 2

NIOSH METHOD 7400

PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Note 2) (Liters)	Sampling Rate (liters/min.)
Inside Abatement Area	0.5/140 Square Meters (Notes 3 & 4)	0.45 microns	3850	2-16
Each Room in 1 Abatement Area Less than 140 Square meters		0.45 microns	3850	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.
2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.
3. One sample shall be added for each additional 140 square meters. (The corresponding I-P units are 5/1500 square feet).
4. A minimum of 5 samples are to be taken per abatement area, plus 2 field blanks.

TABLE 3

EPA AHERA METHOD: TEM AIR SAMPLING PROTOCOL

Location Sampled	Minimum No. of Samples	Filter Pore Size	Min. Vol. (Liters)	Sampling Rate (Liters/min)
Inside Abatement Area	5	0.45 microns	1500	2-16
Outside Abatement Area	5	0.45 microns	1500	2-16
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.
2. The detection limit for TEM analysis is 70 structures/square mm.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME _____ CONTRACT NO. _____

PROJECT ADDRESS _____
CONTRACTOR FIRM NAME _____
EMPLOYEE'S NAME _____,_____,____,
(Print) (Last) (First) (MI)

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that you be provided and you complete formal asbestos training specific to the type of work you will perform and project specific training; that you be supplied with proper personal protective equipment including a respirator, that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you. The Contractor's Designated Industrial Hygienist will check the block(s) for the type of formal training you have completed. Review the checked blocks prior to signing this certification.

FORMAL TRAINING:

a. For Competent Persons and Supervisors: I have completed EPA's Model Accreditation Program (MAP) training course, "Contractor/Supervisor", that meets this State's requirements.

b. For Workers:

(1) For OSHA Class I work: I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

(2) For OSHA Class II work (where there will be abatement of more than one type of Class II materials, i.e., roofing, siding, floor tile, etc.): I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

(3) For OSHA Class II work (there will only be abatement of one type of Class II material):

(a) I have completed an 8-hour training class on the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls of 29 CFR 1926.1101(g) and hands-on training.

(b) I have completed EPA's MAP training course, "Worker", that meets this State's requirements.

(4) For OSHA Class III work: I have completed at least a 16-hour course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, Section .92(a)(2) and the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926.1101, and hands-on training.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

(5) For OSHA Class IV work: I have completed at least a 2-hr course consistent with EPA requirements for training of local education agency maintenance and custodial staff at 40 CFR 763, (a)(1), and the elements of 29 CFR 1926.1101(k)(9)(viii), in addition to the specific work practices and engineering controls at 29 CFR 1926.1101(g) and hands-on training.

c. Workers, Supervisors and the Designated Competent Person: I have completed annual refresher training as required by EPA's MAP that meets this State's requirements.

PROJECT SPECIFIC TRAINING:

___ I have been provided and have completed the project specific training required by this Contract. My employer's Designated Industrial Hygienist and Designated Competent Person conducted the training.

RESPIRATORY PROTECTION:

___ I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair and contact lens use policy of my employer.

RESPIRATOR FIT-TEST TRAINING:

___ I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit check upon donning negative pressure respirators each time.

EPA/CA CERTIFICATION/LICENSE

I have an EPA/CA certification as:
Building Inspector/Management Planner; Certification #_____
Contractor/Supervisor, Certification # _____
Project Designer, Certification # _____
Worker, Certification # _____

MEDICAL EXAMINATION:
___ I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's Industrial Hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

___ were no limitations to performing the required work tasks.
___ were identified physical limitations to performing the required work tasks.

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

Date of the medical examination _____

Employee Signature _____ date _____

Contractor's Industrial
Hygienist Signature _____ date _____

TABLE 02 82 14-1 – Summary of ACM

MATERIAL DESCRIPTION	MATERIAL LOCATION	FRIABILITY	CONDITION	REMOVAL METHODOLOGY	APPROX. QUANTITY
Gypsum Wall and Ceiling Board	Bldg. 14424 Tower Interior	Friable	Damaged	Class I Work – Friable, Full Containment Procedures	2,000 SF
Joint Compound assoc. with Gypsum Wall Board	Bldg. 14424 Tower Interior	Friable	Damaged		
12”x12” Dark Brown Floor Tiles	Bldg. 14424 Tower, 1st Aid Room	Non-friable	Damaged	Class II Work – Non-Friable, Wet Procedures	42 SF
ACM Cement Board Wall Panels	Bldg. 14424 Tower Exterior, 3rd Level	Non-friable	Good	Class II Work – Non-Friable, Wet Procedures	100 SF
Built-up Roofing	Bldg. 14424 Tower, 3rd Level	Non-friable	Damaged	Class II Work – Non-Friable, Wet Procedures	620 SF
Roofing/Flashing	Bldg. 14424 Tower Top Roof	Non-friable	Damaged	Class II Work – Non-Friable, Wet Procedures	64 SF
Gypsum Wall and Ceiling Board	Bldg. 14425 Snack Bar	Friable	Damaged	Class I Work – Friable, Full Containment Procedures	4,100 SF
Joint Compound assoc. with Gypsum Wall Board	Bldg. 14425 Snack Bar	Friable	Damaged		
				Total	6,926 SF

END OF SECTION 02 82 14

SECTION 02 83 13 - LEAD PAINT ABATEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z88.2	(2015) Respiratory Protection

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.103	Respiratory Protection
29 CFR 1926.21	Safety Training and Education
29 CFR 1926.33	Access to Employee Exposure and Medical Records
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59	Hazard Communication
29 CFR 1926.62	Lead
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packaging

CALIFORNIA STATE REGULATIONS

8 CCR 1532.1	Lead
17 CCR, Division 1, Chapter 8	Accreditation, Certification, and Work Practices for Lead-Based Paint and Lead Hazards

UNDERWRITERS LABORATORIES (UL)

UL 586	(2009) Standard for High-Efficiency Particulate, Air Filter Units

ENVIRONMENTAL REPORT REFERENCE MATERIALS

For a complete listing of all analytical findings for lead, refer to the survey report titled "Environmental Services Report". This report shall be provided as appendices together with the bid documents.

1.2 DEFINITIONS

1.2.1 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period.

1.2.2 Area Sampling

Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

1.2.3 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. A Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

1.2.4 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

1.2.5 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

1.2.6 High Efficiency Particulate Arrestor (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

1.2.7 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

1.2.8 Lead Control Area

A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to

prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

1.2.9 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula: PEL (micrograms/cubic meter of air) = 400/No. hrs worked per day.

1.2.10 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

As lead was identified in the paints, for the purpose of complying with the Cal/OSHA lead in construction regulation (8 CCR 1532.1), all coated surfaces shall be considered to contain some lead and require demolition dust control procedures for compliance with Cal/OSHA's Construction Lead Standard under 8 CCR 1532.1. The aforementioned regulation contains requirements for lead air monitoring, work practices, respiratory protection, etc., that are triggered by the presence of even very low levels of lead.

1.2.11 Personal Sampling

Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at the nose or mouth of an employee.

1.2.12 Physical Boundary

Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.

1.3 DESCRIPTION

1.3.1 Description of Work

Construction activities impacting PWL or material containing lead which are covered by this specification include the demolition and/or removal of material containing lead in fair to poor condition, located throughout the building and as indicated in Table 1 at the end of this section.

Current EPA and Cal/EPA regulations do not require LBP to be removed prior to demolition, unless loose and peeling. Provided that the paint coatings are securely adhered to the substrates (i.e., non-flaking or non-peeling), disposal of intact demolition debris can generally be handled in California as non-hazardous and non- RCRA waste, pending receipt of waste characterization testing following demolition. In California, loose and peeling LBP or other wastes require characterization and testing for leachability.

Conventional demolition techniques may be employed for all painted surfaces with the Contractor complying with applicable OSHA and Cal/OSHA statutes regarding:

- Worker awareness training;
- Exposure monitoring, as needed;
- Medical examinations, which may include blood lead level testing; and
- Establishing a written respiratory protection program.

Trigger Tasks

Three sets of specified tasks (Trigger Tasks) require basic protective measures where lead is present until the employer performs an employee exposure assessment. For all three sets of tasks, employers are required to provide the following basic protective measures until air monitoring indicates exposure levels are at or below the PEL:

a. Appropriate respiratory protection
b. Appropriate personal protective coverings
c. Change areas with separate storage facilities for work and street clothes.
d. Hand washing facilities
e. Biological monitoring
f. Training including Hazard Communication Standard, respirator care and use and lead training

The following are Lowest Exposure Tasks where lead coatings are present assume exposures between 50 and 500 ug/m^3 unless proven otherwise:

a. Manual demolition of structures
b. Manual scraping
c. Manual sanding
d. Heat gun applications
e. Power tool cleaning and dust collection
f. Spray painting with lead
g. Any other task where the employer has reason to believe employees may be exposed over the PEL.

The following are Medium Exposure Tasks where lead coatings are present assume exposures between 500 and 2,500 ug/m^3 unless proven otherwise.

a. Use of lead containing mortar
b. Lead burning
c. Rivet busting
d. Power tool cleaning without dust collection system
e. Cleanup of dry expendable abrasives
f. Abrasive blasting enclosure movement or removal

The Highest Exposure Tasks where lead coatings are present assume lead exposures greater than 2,500 ug/m^3 include:

a. abrasive blasting
b. welding
c. cutting
d. torch burning.

1.3.2 Coordination with Other Work

The contractor shall coordinate with work being performed in adjacent areas. Coordination procedures shall be explained in the Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead activities.

1.4 SUBMITTALS

The following shall be submitted :

Preconstruction Submittals

Occupational and Environmental Assessment Data Report (if objective data is used to justify excluding the initial occupational exposure assessment);

Lead Compliance Plan including CP approval (signature, date, and certification number);

Competent Person qualifications;

Training Certification of workers and supervisors;

lead waste management plan;

written evidence that TSD is approved for lead disposal;

Certification of Medical Examinations;

Lead Work Pre-Job Notification to Cal-OSHA no less than 5 days prior to starting Lead Related;

Construction Work Activities or Lead Abatement Activities;

CDPH 8551 (Abatement of Lead Hazards Notification) to CDPH no less than 5 days prior to starting;

Lead Related Construction Work Activities or Lead Abatement activities.

During-construction Submittals

Sampling results

Occupational and Environmental Assessment Data Report

Certificates/Testing laboratory qualifications;

Closeout Submittals

Final Abatement Report which includes but not limited to: summary of all activities, all logs, licenses, certifications, lab results, clearance results;
Completed and signed hazardous waste manifest from treatment or disposal facility;

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62) which shows ability to assess occupational and environmental exposure to lead, experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Submit proper documentation that the CP is trained and certified in accordance with federal, State and local laws.

1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead training specified in 29 CFR 1926.62(l).

For lead hazards and abatement: Comply with the applicable requirements of the Cal/OSHA Lead in Construction Standard, 8 CCR Section 1532.1; Cal/EPA Regulation 22 CCR Section 66000, et seq.; California Department of Public Health (CDPH) Regulation 17 CCR 35001, et seq.

Lead-Hazard Work: All affected workers shall have lead awareness training, current medical examinations and approval for the use of respiratory protection, and current fit testing of respirators complying with Cal/OSHA regulation 8 CCR 1532.1 when affecting lead paints and lead construction hazards including, but not limited to:

a) Demolishing or salvaging structural items where lead or material containing lead are present.
b) Removing or encapsulating materials containing lead.

c) Constructing, altering, repairing or renovating structures, substrates, or portions thereof that contain lead or materials containing lead.
d) Installing of products containing lead.
e) Cleaning-up of lead contamination.
f) Transporting, disposing, storing, or containing lead or lead-containing materials on the site or other locations where construction and demolition activities are performed.

The California Department of Public Health (CDPH) requires the use of Certified Lead Workers and Supervisors for lead abatement projects at public Buildings with a greater than 20 years expected life or whenever work is completed specifically to abate Lead-Based Paint as defined by HUD. The CDPH certification requirements do not apply to industrial sites; however, dust controls and personnel protection are still required under 17 CCR Sections 35001 through 36100.

Certified Lead Worker: includes those who do lead-related construction work activities on a work site under the directions of a Certified Lead Supervisor, including:

1. Removal, disposal or abatement of loose and peeling lead-based paints as defined by HUD, including scraping, demolition or other Cal/OSHA Activity I through 3 work as defined above lasting over 20 years.
2. Removal or repair of lead plumbing.
3. Repainting or general construction on surfaces painted with lead-based paints.
4. Removal, enclosing or covering of lead-contaminated soils.
5. Note that renovations, remodeling, painting, operations and maintenance work or other activities listed above that are considered to be interim controls, or lasting under 20 years, may be completed by workers satisfying Cal/OSHA's asbestos awareness training requirements only.

Certified Lead Supervisor: includes those who supervise daily work activities on a lead-related construction site, as well as supervision of repainting or general construction performed on surfaces with lead-based paints where abatement is designed to permanently reduce or eliminate lead hazards for public (non-industrial) buildings or to last more than 20 years. The Certified Lead Supervisor shall oversee the Certified Lead Workers, enforce safe work practices, and schedule and coordinate work site activities with the building occupants and other contractors and consultants.

Only qualified persons with California Department of Public Health' (CDPH)-approved Lead Workers training, annual medical examinations and approval for the use of respiratory protection, and current fit testing of respirators under the direct supervision of a CDPH approved Lead Abatement Supervisor shall engage in work defined under Cal/OSHA regulation 8 CCR 1532.1 affecting lead-based paints and lead construction hazards, including but not limited to:

1) Working in an environment where lead exposures exceed 30 micrograms/m^3
2) Abating lead-based paints, including but not limited to abatement of loose and peeling lead-based paints, demolition and disposal of concrete-encased primed structural steel and/or stripping of lead coatings from structural steel prior to torching or welding.
3) As defined under Title 17, California Code of Regulations (CCR), Division I, Chapter 8 "Accreditation, Certification and Work Practices in Lead-Related Construction," Article I, Sections 35001 et al, and Article 16, Section 36000 and 36100.

1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air [and wipe] analysis, testing, and reporting of airborne concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis shall be OSHA approved.

1.5.1.4 Third Party Consultant Qualifications

Submit the name, address and telephone number of the independent, third-party consultant selected to perform the wipe sampling for determining concentrations of lead in dust. Submit proper documentation that the consultant is

trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

1.5.2 Requirements

1.5.2.1 Competent Person (CP) Responsibilities

a. Verify training meets all federal, State, and local requirements.

b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.

c. Continuously inspect PWL or MCL work for conformance with the approved plan.

d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.

e. Ensure work is performed in strict accordance with specifications at all times.

f. Control work to prevent hazardous exposure to human beings and to the environment at all times.

g. Supervise final cleaning of the lead control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.

h. Certify the conditions of the work as called for elsewhere in this specification.

1.5.2.2 Lead Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of PWL or MCL. The plan shall include a sketch showing the location, size, and details of lead control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and dust containing lead and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Compliance Plan.

a. The initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.

b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.

c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.

1.5.2.4 Medical Examinations

Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

1.5.2.5 Training

Train each employee performing work that disturbs lead, who performs MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations where appropriate.

1.5.2.6 Respiratory Protection Program

a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.

b. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.

1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CRF 1926.59.

1.5.2.8 Lead Waste Management

The Lead Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations and address:

a. Identification and classification of wastes associated with the work.

b. Estimated quantities of wastes to be generated and disposed of.

c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of USEPA hazardous waste manifests.

Project Manager must request Federal EPA ID from park at least 96 hours before developing draft manifest. Draft manifest must be reviewed by park Environmental Protection Specialist 48 hours before hazardous waste bin pickup.

d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.

e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.

g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Wastes shall be cleaned up and containerized daily.

h. Include any process that may alter or treat waste rendering a hazardous waste non-hazardous for park consideration at least 6 weeks in advance of proposed treatment.

i. Unit cost for hazardous waste disposal according to this plan.

Current EPA and Cal/EPA regulations do not require LBP to be removed prior to demolition, unless loose and peeling. Provided that the paint coatings are securely adhered to the substrates (i.e., non-flaking or non-peeling), disposal of intact demolition debris can generally be handled in California as non-hazardous and non- RCRA waste, pending receipt of waste characterization testing following demolition. In California, loose and peeling LBP or other wastes require characterization and testing for leachability.

1.5.2.9 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.

1.5.3 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust, fume and mist. Respirators shall comply with the requirements of 29 CFR 1926.62.

1.6.2 Special Protective Clothing

Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

1.6.5 Equipment for Contracting Officer

Furnish the Contracting Officer with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, eye and hand protection. PPE shall remain the property of the Contractor. The Client will provide respiratory protection for the CO.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Notification

a. Notify the Contracting Officer 20 days prior to the start of any lead work.

3.1.1.2 Lead Control Area

a. Physical Boundary - Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside of the lead control area.

b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.1.1.3 Furnishings

The Government will remove furniture and equipment from the building before lead work begins.

3.1.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.

3.1.1.5 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

3.1.1.6 Eye Wash Station

Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.

3.1.1.7 Mechanical Ventilation System

a. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Local exhaust ventilation systems shall be evaluated and maintained in accordance with 29 CFR 1926.62.

b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.

c. Use locally exhausted, power actuated tools or manual hand tools.

3.1.1.8 Personnel Protection

Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

3.2 ERECTION

3.2.1 Lead Control Area Requirements

Establish a lead control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed. Lead control measures shall be such as to minimize airborne lead-containing dust.

3.3 3.3 APPLICATION

3.3.1 Lead Work

Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

3.3.2 Paint with Lead or Material Containing Lead Removal

Manual or power sanding or grinding of lead surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for removing lead in the Lead Compliance Plan. Select lead removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this removal process in the Lead Compliance Plan.

3.3.2.1 Paint with Lead or Material Containing Lead - Indoor Removal

Perform manual removal in the lead control areas using enclosures, barriers or containments and powered locally exhausted tools. Collect residue debris for disposal in accordance with federal, State, and local requirements.

3.3.2.2 Paint with Lead or Material Containing Lead - Outdoor Removal

Perform outdoor removal as indicated in federal, State, and local regulations and in the Lead Compliance Plan. The worksite preparation (barriers or containments) shall be job dependent and presented in the Lead Compliance Plan.

3.3.2.3 Freezing & Flexing Paint Removal

The Contractor has the option to utilize the Freezing & Flexing paint removal methodology on metal ceiling panels. This methodology has been approved by and was successfully used on properties owned by NPS. The methodology involves careful removal of metal ceiling panels in sections, freezing them in refrigerated containers which causes the metal to contract, breaking its bonds with the paint, which can then be scraped off easily.

The following reference articles have information on this methodology:

http://greensource.construction.com/green_building_projects/2009/0909_Cavallo-point.asp
http://www.northbaybusinessjournal.com/13247/historic-top-project-restoration-cavallo-point-the-lodge-at-the-golden-gate/

All work must comply with federal, State and local regulations and must be conducted by Lead Abatement Contractor.

3.3.2.4 Paint Encapsulation

Section not used.

3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn in the control area:

a. Vacuum all clothing before entering the contaminated change room.

b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.

c. Shower.

d. Change to clean clothes prior to leaving the clean clothes storage area.

3.4 FIELD QUALITY CONTROL

3.4.1 Tests

3.4.1.1 Air Sampling

Conduct sampling for lead in accordance with 29 CFR 1926.62 and as specified herein. Air sampling shall be directed or performed by the CP.

a. The CP shall be on the job site directing the air sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.

b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.

c. Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken.

d. Conduct area air sampling daily, on each shift in which lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the conditions(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after the CP and the Contracting Officer give approval.

3.4.1.2 Sampling After Removal

Section not used

3.5 CLEANING AND DISPOSAL

3.5.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operation has been completed, clean the controlled area of

visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before clearance testing.

3.5.1.1 Clearance Certification

The third party consultant shall certify surface wipe sample results collected inside and outside the work area are less than 10 micrograms per 0.1 square meter square foot on floors, less than 100 micrograms per 0.1 square meter square foot on interior window sills and less than 400 micrograms per 0.1 square meter square foot on window troughs.

Clear the lead control area in industrial facilities of all visible dust and debris.

3.5.2 Disposal

a. All material, whether hazardous or non-hazardous shall be disposed in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.

b. Contractor is responsible for segregation of waste. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261.

c. Dispose of lead-contaminated material classified as hazardous waste at an EPA approved hazardous waste treatment, storage, or disposal facility off the property.

d. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.

e. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

f. None of the applicable regulations require removal of lead paint prior to renovation if the paints are securely adhered to the substrates (i.e., non-flaking or non-peeling). Disposal of the demolition debris in this case can be handled as non-hazardous and non-RCRA waste after the loose and flaking paint have been removed, as long as demolition practices do not compromise worker safety.

g. Based on the California Total Threshold Level Concentration (TTLC) hazardous waste standard, the paints may be classified as hazardous wastes. Additional sampling and analysis for leachable lead content by the Contractor during demolition will be required for waste l of these materials may be as RCRA or California hazardous waste pending receipt of analytical waste characterization data.

3.5.2.1 Disposal Documentation

Submit written evidence to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility.

3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to the Client.

TABLE 1 – Lead-Based Paints (LBP) and Lead-containing Paints (LCP)

Material Description	Location	Condition	Result % Lead by Weight	LBP/LCP	Approx. Quantity
Blue paint on wood posts	Tower Exterior	Significantly Damaged	0.024	LCP	350 SF
Brown paint on metal sign	Exterior	Significantly Damaged	0.64	LBP	10 SF
Blue paint on metal stair rails	Tower Interior 2nd Floor	Significantly Damaged	0.43	LCP	50 SF
Blue paint on exterior wood siding	Snack Bar Exterior	Significantly Damaged	0.01	LCP	800 SF
White paint on exterior wood trim	Snack Bar Exterior	Significantly Damaged	0.023	LCP	250 SF
Black paint on wood door	Snack Bar	Damaged	0.022	LCP	60 SF
White paint on wood door	Snack Bar	Significantly Damaged	0.065	LBP	120 SF

-- End of Section –

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Form materials, waterstops, and accessories required to form cast-in-place concrete.
2. Section 260526 - Grounding and Bonding for Electrical Systems: Grounding concrete reinforcement.
3. Section 316223 - Composite Piles: Cast-in-place concrete-filled steel pipe piles.
4. Section 316300 - Bored Piles: Cast-in-place concrete footings.
5. Section 316329 - Drilled Concrete Piers and Shafts: Reinforcement for foundations.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

C. ASTM International:

1. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM A704 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
4. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
5. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
6. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

7. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
8. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
9. ASTM A996 - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
10. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

D. Concrete Reinforcing Steel Institute:

1. CRSI 10-MSP - Manual of Standard Practice.
2. CRSI 10PLACE - Placing Reinforcing Bars.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with placement of formwork, formed openings, and other Work.

1.4 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Indicate bar sizes, spacings, locations, splice locations, and quantities of reinforcing steel and welded wire fabric.
2. Indicate bending and cutting schedules.
3. Indicate supporting and spacing devices.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Submit certified copies of mill test report of reinforcement materials analysis.

E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statement:

1. Welders: Qualify procedures and personnel according to AWS D1.1.

1.6 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify that following products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project Site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for following products:

a. Products with recycled material content.
b. Regional products.

1.7 QUALITY ASSURANCE

A. Perform Work according to ACI 301 and ACI 318.

B. Prepare Shop Drawings according to ACI SP-66.

C. Perform Work according to local jurisdiction standards.

D. Maintain one copy of each standard affecting Work of this Section on Site.

1.8 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months for employed weld types.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

2.2 REINFORCEMENT

A. Reinforcing Steel:

1. Comply with ASTM A615.
2. Yield Strength: 60 ksi.
3. Billet Bars: Plain.
4. Finish: Epoxy coated.

B. Plain Bar Mats:

1. Material: Steel bars.
2. Comply with ASTM A704.
3. Fabrication: ASTM A615 or ASTM A706.
4. Yield Strength: 60 ksi.
5. Finish: Epoxy coated.

C. Welded Plain Wire Fabric:

1. Comply with ASTM A1064.
2. Configuration: Flat sheets.
3. Finish: Epoxy coated.

2.3 FABRICATION

A. Fabricate concrete reinforcement according to ACI 318.

B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks, and seismic hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters according to ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form ties and stirrups from following:

1. Bars No. 10 and Smaller: No. 3 deformed bars.
2. Bars No. 11 and Larger: No. 4 deformed bars.

F. Weld reinforcement according to AWS D1.4.

G. Epoxy-Coated Reinforcement: Clean surfaces, weld, and re-protect welded joint according to CRSI 10PLACE.

H. Splicing:

1. If not indicated on Drawings, locate reinforcement splices at point of minimum stress.

2.4 SHOP FINISHING

A. Epoxy-Coated Finish for Steel Bars: Comply with ASTM A775.

B. Epoxy-Coated Finish for Steel Wire: Comply with ASTM A884 , Class A.

2.5 ACCESSORY MATERIALS

A. Tie Wire:

1. Minimum 16 gage, 316 Stainless Steel

B. Chairs, Bolsters, Bar Supports, and Spacers:

1. Size and Shape: To strengthen and support reinforcement during concrete placement conditions.
2. Furnish load-bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather-Exposed Concrete Surfaces:

1. Material: Plastic-coated steel.
2. Size and Shape: To meet Project conditions.

D. Reinforcing Splicing Devices: 1. Type: Exothermic welding type; full tension and compression.

E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.6 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

C. Owner Inspection:

1. Make completed concrete reinforcing available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

D. Owner Witnessing:

1. Allow witnessing of factory inspections and test at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

E. Certificate of Compliance:

1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Place, support, and secure reinforcement against displacement.

B. Do not deviate from required position beyond specified tolerance.

C. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.

D. Do not displace or damage vapor retarder.

E. Accommodate placement of formed openings.

F. Spacing:

1. Space reinforcement bars with minimum clear spacing according to ACI 318.
2. If bars are indicated in multiple layers, place upper bars directly above lower bars.

G. Maintain minimum concrete cover around reinforcement according to ACI 318 as follows:

1. Footings and Concrete Formed against Earth: 3 inches.
2. Concrete Exposed to Earth or Weather:

a. No. 6 Bars and Larger: 3 inches.
b. No. 5 Bars and Smaller: 3 inches.

H. Splice reinforcing according to manufacturer's instructions.

I. Bond and ground reinforcement as specified in Section 260526 - Grounding and Bonding for Electrical Systems.

3.2 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Install reinforcement within following tolerances for flexural members, walls, and compression members:

a. Depth Tolerance: Plus or Minus 3/8 inch.
b. Concrete Cover Tolerance: Plus or Minus 3/8 inch.

C. Foundation Walls: Install reinforcement within tolerances according to ACI 530/530.1.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Perform field inspection and testing according to ACI 318.

C. Provide unrestricted access to Work and cooperate with appointed inspection and testing firm.

D. Reinforcement Inspection:

1. Placement Acceptance: Inspect specified and ACI 318 material requirements and specified placement tolerances.
2. Welding: Inspect welds according to AWS D1.1.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Weldability Inspection: Inspect for reinforcement weldability if formed from steel other than ASTM A706.
5. Continuous Weld Inspection: Inspect reinforcement according to ACI 318.
6. Periodic Weld Inspection: Inspect other welded connections.

END OF SECTION 03-20-00

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete.
2. Shoring, bracing, and anchorage.
3. Architectural form liners.
4. Form accessories.
5. Form stripping.

B. Related Requirements:

1. Section 032000 - Concrete Reinforcing: Reinforcing steel and required supports for cast-in-place concrete.
2. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frame, slabs-on-grade, and other concrete components associated with building.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest & Paper Association:

1. AF&PA - National Design Specification (NDS) for Wood Construction.

C. American Society of Mechanical Engineers:

1. ASME A17.1 - Safety Code for Elevators and Escalators.

D. APA - The Engineered Wood Association:

1. APA/EWA PS 1 - Voluntary Product Standard - Structural Plywood.

E. West Coast Lumber Inspection Bureau:

1. WCLIB - Standard No. 17 Grading Rules for West Coast Lumber.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with other Sections of Work in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information on void form materials and installation requirements.

C. Shop Drawings:

1. Indicate:

a. Formwork, shoring, and reshoring.
b. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
c. Means of leakage prevention for concrete exposed to view in finished construction.
d. Sequence and timing of erection and stripping, assumed compressive strength at time of stripping, height of lift, and height of drop during placement.
e. Vertical, horizontal, and special loads according to ACI 347, and camber diagrams when applicable.
f. Notes to formwork erector showing size and location of conduits and piping embedded in concrete according to ACI 318.
g. Procedure and schedule for removal of shores and installation and removal of reshores.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Delegated Design Submittals:

1. Submit signed and sealed Shop Drawings with design calculations and assumptions for formwork and shoring.
2. Indicate loads transferred to structure during process of concreting, shoring, and reshoring.
3. Include structural calculations to support design.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statement:

1. Submit qualifications for licensed professional.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify that following products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project Site.
c. Certify that lumber is harvested from FSC-Certified well-managed forest.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for following products:

a. Products with recycled material content.
b. Regional products.
c. Certified wood products.

1.6 QUALITY ASSURANCE

A. Perform Work according to ACI 347, 301, and 318.

B. For wood products furnished for Work of this Section, comply with AF&PA.

C. Maintain one copy of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

A. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of California.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept void forms on Site in manufacturer's original packaging and inspect for damage.

C. Store materials off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Design, engineer, and construct formwork, shoring, and bracing according to ACI 318to conform to applicable code requirements to achieve concrete shape, line, and dimension as indicated on Drawings.

B. Vapor Retarder Permeance: Maximum 1 perm when tested according to ASTM E96 , water method.

2.2 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

3. Certified Wood Materials: Furnish wood materials certified according to FSC standards.

2.3 PREFABRICATED FORMS

A. Preformed Steel Forms:

1. Description: Matched, tightly fitted, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
2. Minimum Thickness: 16 gage.

B. FRP Forms: Matched, tightly fitted, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

C. Pan:

1. Material: Steel.
2. Configuration: Size and profile as required.

D. Void Forms:

1. Moisture-resistant treated paper faces; biodegradable.
2. Structurally sufficient to support weight of wet concrete mix until initial set.
3. Thickness: 2 inches .

E. Steel Forms:

1. Description: Sheet steel, suitably reinforced.
2. Design: For particular use as indicated on Drawings.

F. Form Liners: Smooth, durable, grainless, and non-staining hardboard unless otherwise indicated on Drawings.

G. Framing, Studding, and Bracing: Stud.

2.4 COATINGS

A. Coatings for Aluminum:

1. Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate.
2. One coat primer and one coat finish.
3. Minimum Total Dry Film Thickness: 6-9 mils.

2.5 FORMWORK ACCESSORIES

A. Form Ties:

1. Type: Snap off.
2. Material: 316 Stainless
3. Length: Adjustable.
4. Furnish waterproofing washer.
5. Free of defects capable of leaving holes larger than 1 inch in concrete surface.

B. Spreaders:

1. Description: Standard, non-corrosive metal-form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face.
2. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Release Agent:

1. Description: Colorless mineral oil that will not stain concrete or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.

D. Corners:

1. Type: Chamfer.
2. Size: 0.75 by 0.75 inches .
3. Lengths: Maximum possible.

E. Dovetail Anchor Slot:

1. Material: 316 Stainless steel.
2. Thickness: 22 gage.
3. Filling: None.

4. Fasten slot to concrete formwork according to manufacturer instructions, and insert foam filler to prevent concrete from entering slot during pour.

F. Flashing Reglets:

1. Material: 316 Stainless steel.
2. Thickness: 22 gage.
3. Lengths: Maximum possible.
4. Furnish alignment splines for joints.
5. Filling: None.
6. Fasten flashing reglet to concrete formwork according to manufacturer instructions, and insert foam to prevent concrete from entering reglet during pour.

G. Vapor Retarder:

1. Description: Polyethylene sheet.
2. Thickness: 8 mils .

H. Bituminous Joint Filler: Comply with ASTM D1751.

I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.

J. Waterstop:

1. Material: Rubber.
2. Tensile Strength: Minimum 1,750 psi.
3. Working Temperature Range: Minus 50 to plus 175 degrees F.
4. Width: 4 inches.
5. Lengths: Maximum possible.
6. Profile: Ribbed.
7. Corner Sections: Preformed.
8. Jointing: Heat welded.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify lines, levels, and centers before proceeding with formwork.

C. Verify that dimensions agree with Drawings.

D. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Contracting Officer before proceeding.

3.2 INSTALLATION

A. Earth Forms: Not permitted.

B. Formwork:

1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless indicated otherwise on Drawings.
4. Positioning:

    a. Carefully verify horizontal and vertical positions of forms.
    b. Correct misaligned or misplaced forms before placing concrete.

5. Complete wedging and bracing before placing concrete.
6. Erect formwork, shoring, and bracing to achieve design requirements according to ACI 301.
7. Stripping:

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

8. Obtain approval of Contracting Officer before framing openings in structural members not indicated on Drawings.
9. Install chamfer strips on external corners of beams and columns.
10. Install void forms according to manufacturer instructions.
11. Do not reuse wood formwork more than two times for concrete surfaces to be exposed to view.
12. Do not patch formwork.
13. Leave forms in place for minimum number of days according to ACI 347.

C. Form Removal:

1. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads, and removal has been approved by Contracting Officer.
2. Loosen forms carefully; do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
3. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged.
4. Discard damaged forms.
5. Form Release Agent:

    a. Apply according to manufacturer instructions.
    b. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
    c. Do not apply form release agent if concrete surfaces are indicated to receive special finishes or applied coverings that may be affected by agent.

d. Soak inside surfaces of untreated forms with clean water, and keep surfaces coated prior to placement of concrete.

6. Form Cleaning:

a. Clean forms as erection proceeds to remove foreign matter within forms.
b. Clean formed cavities of debris prior to placing concrete.
c. Flush with water or use compressed air to remove remaining foreign matter.
d. Ensure that water and debris drain to exterior through cleanout ports.
e. Cold Weather:

1) During cold weather, remove ice and snow from within forms.
2) Do not use de-icing salts.
3) Do not use water to clean out forms unless formwork and concrete construction proceed within heated enclosure; use compressed air or other dry method to remove foreign matter.

7. Reuse and Coating of Forms:

a. Thoroughly clean forms and reapply form coating before each reuse.
b. For exposed Work, do not reuse forms with damaged faces or edges.
c. Apply form coating to forms according to manufacturer instructions.
d. Do not coat forms for concrete indicated to receive "scored finish."
e. Apply form coatings before placing reinforcing steel.

D. Forms for Smooth Finish Concrete:

1. Use steel, plywood, or lined-board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full-sized sheets of form liners and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Apply forming and strip wood forms in a manner to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

E. Forms for Surfaces to Receive Membrane Waterproofing:

1. Use plywood or steel forms.
2. After erection of forms, tape form joints to prevent protrusions in concrete.

F. Framing, Studding, and Bracing:

1. Maximum Spacing of Studs:

a. Boards: Maximum 16 inches o.c.
b. Plywood: 12 inches o.c.

2. Size framing, bracing, centering, and supporting members for sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement, and accidental impact.

G. Form Anchors and Hangers:

1. Do not use anchors and hangers leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural-steel members to minimize twisting or rotation of member.
3. Penetration of structural-steel members is not permitted.

H. Inserts, Embedded Parts, and Openings:

1. Install formed openings for items to be embedded in or passing through concrete Work.
2. Locate and set in place items required to be cast directly into concrete.
3. Position recessed reglets for brick veneer masonry anchors according to spacing and intervals as indicated on Drawings.
4. Install accessories straight, level, and plumb, and ensure that items are not disturbed during concrete placement.
5. Joints:

    a. Install waterstops continuous without displacing reinforcement.

6. Openings:

    a. Provide temporary ports or openings in formwork as required to facilitate cleaning and inspection.
    b. Locate openings at bottom of forms to allow flushing water to drain.

7. Close temporary openings with tight-fitting panels, flush with inside face of forms, and neatly fitted such that joints will not be apparent in exposed concrete surfaces.

I. Form Ties:

1. Provide sufficient strength and quantity to prevent spreading of forms.
2. Place ties at least 3 inches away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless indicated otherwise on Drawings.

J. Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

K. Construction Joints:

1. Install surfaced pouring strip where construction joints intersect on exposed surfaces to provide straight line at joints.

2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Appearance:

    a. Show no overlapping of construction joints.
    b. Construct joints to present same appearance as butted plywood joints.

4. Arrange joints in continuous line straight, true, and sharp.

L. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Ensure that conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 regarding size and location limitations.

M. Openings for Items Passing through Concrete:

1. Frame openings in concrete where indicated on Drawings.
2. Establish exact locations, sizes, and other conditions required for openings and attachment of Work specified under other Sections.
3. Coordinate Work to avoid cutting and patching of concrete after placement.
4. Perform cutting and repairing of concrete required as result of failure to provide required openings.

N. Screeds:

1. Set screeds and establish levels for tops of and finish on concrete slabs.
2. Slope slabs to drain where required or as indicated on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms; remove freestanding water.

O. Screed Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle-, pad-, or base-type screed supports that will not puncture membrane.
2. Staking through membrane is not permitted.

P. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.
2. Clean forms and surfaces against which concrete is to be placed.
3. Remove chips, sawdust, and other debris.
4. Thoroughly blow out forms with compressed air just before concrete is placed.

3.3 TOLERANCES

A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances according to ACI 117.

B. Camber:

1. Slabs and Beams: 1/4 inch per 10 feet.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Inspection:

1. Inspect erected formwork, shoring, and bracing to ensure that Work complies with formwork design and that supports, fastenings, wedges, ties, and items are secure.
2. Notify Contracting Officer after placement of reinforcing steel in forms but prior to placing concrete.
3. Schedule concrete placement to permit formwork and reinforcing steel inspection by engineer of record 24 hours (previous workday) before placing concrete.

END OF SECTION 03 10 00

SECTION 03 30 00 - CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Foundation systems including footings, piles, beams, and similar concrete.
2. Structural slabs on grade.
3. Cast-in-place slabs and beams.
4. Furnishing and installing all required anchors and inserts.
5. Placing in the forms all inserts, anchors, anchor bolts, bearing plates and the like furnished by other trades for casting into the concrete and cleaning of same after stripping of forms.
6. Protection of all inserts, anchors, hangers, sleeves and supports furnished and set by others for the attachment of other work to the concrete, or required to permit the passage of other work through the concrete.
7. Supply, fabricate and place all required reinforcing bars, mesh and other reinforcement for concrete where shown, called for, and/or required complete with proper supporting devices.
8. Erection and removal of all formwork required to properly complete the work.
9. Finishing of all concrete work as hereinafter specified.
10. Curing and protection of all concrete work.
11. Site concrete consisting of curbs, walls, pads, boxes and the like as shown on the drawings.
12. Floor sealers and dustproofing of all areas exposed and/or covered with carpet.
13. Cutting, patching, grouting, repairing and pointing up as required.
14. Vapor barrier system below slabs on grade.
15. Waterproofing.
16. All other work and materials as may be reasonably inferred and needed to make the work of this section complete.
17. Waste Management

B. Related Requirements:

1. Division 01 Section “Construction Waste Management and Disposal”
2. Division 05 Section “Structural Steel”
3. Division 07 Section “Waterproofing”
4. Division 07 Section “Joint Sealants”

1.3 SUBMITTALS

A. Product Data: Submit data for proprietary materials and items, including the following:

1. Reinforcement
2. Supports for reinforcement
3. Forming accessories
4. Admixtures
5. Patching compounds
6. Waterstops
7. Joint systems
8. Curing compounds
9. Dry-shake finish materials
10. Others items as requested by Architect.

B. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. The shop drawings shall be prepared only by competent detailers, checked by the contractor prior to submission.

1. The shop drawings shall show construction, contraction and isolation joint locations and the added reinforcement required at same.
2. Obtain and coordinate information for sleeves and openings in concrete, which are required for the work of other trades. Make coordinated drawings showing size and location of openings and sleeves and incorporate this information on the reinforcing drawings.
3. Only those splices indicated on the approved shop drawings will be permitted.
4. Provide elevations of all foundation walls and other structural elements to a minimum 1/4" scale.

C. Shop Drawings Formwork: Submit shop drawings for fabrication and erection of specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually. Architect’s review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is Contractor’s responsibility, prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Contracting Officer (CO).

E. Contraction Joint Layout: Indicate proposed contraction joints required per applicable codes and drawings.

1. Location of contraction joints is subject to approval of the CO.

F. The use of the CO's electronic drawing files as a base for the reinforcement, formwork, and joint layout shop drawings will be permitted at the request of the detailer/designer upon completion and return of the waiver form. The use of the CO's electronic drawing files as a base for shop drawing details will not be permitted. The detailer/designer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to detailer/designer and their use will be at the detailer/designer's sole risk and without liability to the design team. The detailer/designer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The detailer/designer shall also remove all reference to work not included in the concrete contract.

G. Scaling of the CO's drawings is not permitted. This applies to hard paper, electronic, and all other versions.

H. Samples: Submit samples of materials as requested by the CO, including names, sources, and descriptions.

I. Laboratory Test Reports: Submit laboratory test reports for concrete materials, mix design test and microwave test.

J. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by the CO. Manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements shall sign material certificates. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

K. Cold Weather and Hot Weather Concreting Procedures: Submit written descriptions of contractor's proposed cold weather and hot weather concreting procedures, when applicable.

L. Certification that pozzolanic materials conform to ASTM C 618-01 (noting class C or class F), ASTM C 989 or ASTM C1240.

M. Formwork: Specify whether reusable, permanent, salvaged or new wood forms are to be used. Salvaged materials must have prior approval by CO.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

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

1. International Building Code, Latest Edition
2. ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials and Commentary.”
3. ACI 211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight and mass concrete.”
4. ACI 214R, “Evaluation of Strength Test Results of Concrete.”
5. ACI 301 “Specifications for Structural Concrete.”
6. ACI 302.1R “Guide for Concrete Floor and Slab Construction.”
7. ACI 304R, “Guide for Measuring, Mixing, Transporting and Placing Concrete.”
8. ACI 305R “Hot Weather Concreting.”
9. ACI 306R-10 “Guide to Cold Weather Concreting.”
10. ACI 308.1 “Standard Specification for Curing Concrete.”
11. ACI 309R, “Guide for Consolidation of Concrete.”
12. ACI 311.4R, “Guide for Concrete Inspections.”
13. ACI 315, “Details and Detailing of Concrete Reinforcement.”
14. ACI 318 “Building Code Requirements for Structural Concrete and Commentary.”
15. ACI 347 “Guide to Formwork of Concrete.”
16. Concrete Reinforcing Steel Institute, (CRSI) “Manual of Standard Practice.”
17. CRSI-WCRSI, “Placing Reinforcing Bars.”
18. The ACI Field Reference Manual, SP-15
19. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.

D. Concrete Testing Service: Contractor will engage a testing laboratory acceptable to NPS Project Manager to perform material evaluation tests and to design concrete mixes.

E. Materials and installed work may require testing and retesting at any time during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

F. Preconstruction Meeting:

1. At least 35 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The Contractor shall send a

pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.

2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

   a. Contractor's superintendent
   b. Concrete subcontractor

3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by the contractor to all parties concerned within 5 days of the meeting.
4. The CO will be present at the conference. The Contractor shall notify the CO and NPS Project Manager at least 10 days prior to the scheduled date of the conference.

1.5 PROJECT CONDITIONS

A. The Contractor, before commencing work, shall examine all adjoining work on which this work is in any way dependent for proper installation and workmanship according to the intent of this specification, and shall report to the NPS project manager any condition which prevents this contractor from performing first class work.

B. Protect adjacent finish materials against spatter during concrete placement.

C. Provide all barricades and safeguards at all pits, holes, etc., to prevent injury to workmen and others within and about the premises. Also provide all safeguards as required by the Building Code, OSHA, or any other departments having jurisdiction. Take full responsibility for all safety precautions and methods.

D. Procedure of Work: The contractor shall keep themself constantly informed as to the progress of the work in the field, materials and workers ready to start work immediately when conditions of preceding work are available or ready, wholly or in part, so as not to delay the progress of building work or to interfere with the progress of work of other contractors, and in any event the contractor shall, within 24 hours after notice from the CO, proceed with such work as directed to maintain the uninterrupted progress of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct of plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous,

straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.

1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better mill oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Preference shall go to salvaged or re-used Dimensional Lumber. Provide lumber dressed on at least 2 edges and one side for tight fit. Salvaged materials must have prior approval by CO.

C. Form Coatings: Provide VOC compliant commercial formulation form- coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces. Use biodegradable form release agent listed below or equivalent made from soy or rapeseed oil.

1. Use "Duogard II" by W. R. Meadows, Inc. or approved equal

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Form Ties: Form ties and spreaders: Wire ties shall not be used. Ties for foundation work shall be of snap design with removal cones and water seal washer. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface and be filled with NPS Project Manger approved material when exposed to earth or the exterior of the structure.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775 (as noted on plan and/or in section).

C. Steel Wire and Welded Wire Reinforcement: 316 Stainless at exterior locations, conditions permanently exposed to weather and/or water, and where noted on drawings (plan and/or sections).

D. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

E. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.

F. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

G. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Use wire bar type supports complying with CRSI specifications.

1. For epoxy coated reinforcement provide plastic protected chairs and plastic ties. All imperfections in the epoxy coating are to be repaired prior to placement of concrete.

a. Use recycled plastic rebar supports (give preference to local supplier if available). Subject to compliance with requirements, provide one of the following:

1) International Plastics Group
2) Eclipse Plastic

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2), at a spacing not to exceed 4'-0" on center in either direction.

2.3 CONCRETE MATERIALS

A. Portland cement: ASTM C 150, Types I, II, or I/II. Total percentage of Portland Cement is NOT to exceed 75% of the cementitious content of each mix. Use one brand of cement throughout project, unless otherwise acceptable to CO.

a. Fly Ash: Cast-in-place concrete shall incorporate fly ash as a replacement for at least 25% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the CO.

B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to CO.
2. Normal weight Fine Aggregate: washed, inert, natural or manufactured or combination thereof, sand conforming ASTM C33 gradation.
3. Normal weight Coarse Aggregate: well graded crushed stone or washed gravel conforming to ASTM C33, sizes 57 for foundations and 67 for slabs and structure.

C. Water: Free from oils, acids, alkali, organic matter and other deleterious material to conform to ASTM C94. Air Entraining Admixture: ASTM C 260.

1. Liquid air entrainment: Subject to compliance with requirements, provide “Air Mix” by Euclid Chemical or equal approved by CO.

E. Water-Reducing Admixture: ASTM C 494.

1. Products: Subject to compliance with requirements, provide “Euclid MR” by Euclide Chemical or equal approved by CO.

F. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and containing not more than 0.05 percent chloride ions.

1. Products: Subject to compliance with requirements, provide "Eucon 37, 1037 or Plastol 5000" by Euclide Chemical or equal approved by CO.

G. Water Reducing, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non- corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Accelerating admixtures are not to be used as antifreeze agents. Accelerating admixtures are permitted only upon review by CO.

1. Products: Subject to compliance with requirements, provide "Accelguard 80" by Euclid Chemical Co. or equal approved by CO.

H. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.05 percent chloride ions.

1. Products: Subject to compliance with requirements, provide "Plastiment" by Sika Chemical Co. or equal approved by CO.

I. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the CO.

J. Corrosion Inhibitor: 30% calcium nitrite (where called for in the specifications or on the drawings). Subject to compliance with requirements, provide the following at 3 gal/cy:

1. “Eucon CIA” by Euclid Chemical or approved equal.

K. Contractor will be required to provide information demonstrating successful use in prior placement involving all admixtures.

2.4 RELATED MATERIALS

A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 1241, Size 57, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 8 sieve.

B. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

C. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Waterproof paper
    b. Polyethylene film
    c. Polyethylene-coated burlap

D. Curing Compounds: The compound shall conform to ASTM C 309. Limit VOC content to 130 g/L. Use water-based curing compound. For surfaces receiving both a curing compound and additional flooring, verify that the curing compound and additional flooring are compatible.

1. Products: Subject to compliance with requirements, provide “Kurez W VOX” by Euclid Chemical Co. or equal approved by CO.

E. Curing & Sealing Compounds: Only specify for slabs that will remain exposed, i.e. will not receive additional flooring. The compound shall conform to ASTM C1315. Limit VOC content to 130 g/L. Use water-based curing compound.

1. Products: Subject to compliance with requirements, provide “Everclear VOX” by Euclid Chemical Co. or equal approved by CO.

F. Sealers/Hardeners: For use on concrete surfaces that will remain exposed. Slabs that will receive additional flooring do not require sealing or hardening. Sealers and hardeners must not yellow under ultraviolet light after 500 hours of test in accordance with and have a maximum moisture loss of 0.039 grams per sq. cm. when applied at a coverage rate of 250 sq. ft. per gallon. Limit VOC content to 130 g/L. Use water- or vegetable-based product.

1. Products: Subject to compliance with requirements, provide “Kure-N-Harden” by BASF or equal approved by CO.

G. Evaporation Retardant: Emulsion of organic compounds that minimize moisture loss from fresh concrete during high winds, low humidity and/or hot temperatures.

1. Products Subject to compliance with requirements, provide "Eucobar" by Euclid Chemical Co. or equal approved by CO.

H. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F 710, coordination with flooring manufacturer is required to ensure concrete coatings will not obstruct the bond between the concrete and the adhesive. Ensure coatings and adhesives are “benignly compatible” -- in other words, do not combine substances whose constituents are reactive. Reactivity releases VOCs and /or other toxic fumes.

I. Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound.

1. Products: Subject to compliance with requirements, provide "Flo-Top 90 or Super Flo-Top" by Euclid Chemical Co. or equal approved by CO.

J. Vapor Barrier: Provide vapor barrier which conforms to ASTM E 1745, Class A or B. The membrane shall have a water-vapor permeance rate no greater than 0.012 perms when tested in

accordance with ASTM E 154, Section 7. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. Vapor barrier shall be no less than 10 mil thick in accordance with ACI 302.1R. Preferred vapor barriers will be manufactured from post-consumer recycled polymers.

1. Products: Subject to compliance with requirements, provide “Stego Wrap (15 mil) Vapor Barrier” by Stego Industries LLC or equal approved by CO.

K. Water: Potable.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. Preparation of Design Mixes

1. All mix designs shall be proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and prepared by a licensed testing laboratory approved by the CO, but paid for by the contractor. Submit mix designs on each class of concrete for review.
2. If previously used mixes are submitted, all materials shall be from the same sources and with the same brand names as the previously utilized mix.
3. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to 1.10f’c+700 psi when concrete strengths greater than 5000 psi are used.
4. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data.

B. Submit each proposed mix to the NPS PROJECT MANAGERfor review at least 5 days prior to the pre-concrete conference. Do not begin concrete production until NPS PROJECT MANAGERhas reviewed and approved mixes.

1. Submit Test reports for any pozzolans or slags indicating compliance with ASTM C 618 or ASTM C 989, respectively.
2. Provide cut sheets clearly indicating the percentages of pozzolans or slags used in the mix design as replacement for Portland cement. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the percentage.
3. Test reports for recycled aggregate indicating compliance with ASTM C 33. Provide cut sheets clearly indicating the percentage of aggregates used that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.
4. Provide cut sheets clearly indicating the percentage of sub-base and filler aggregate materials that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.

C. Design mixes to provide concrete with strength as indicated on drawings and schedules.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to CO.

E. Admixtures:

1. Use water-reducing admixture or high range water-reducing (HRWR) admixture (superplasticizer) in all concrete as required for placement and workability.
2. Use non-corrosive, non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50°F.
3. Use high-range water-reducing admixture in concrete required to be watertight, and concrete with water/cement ratios below 0.50.
4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Exposure category for exterior concrete is F1. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2 percent within following limits:

    a. Concrete structures and slabs exposed to freezing and thawing or deicer chemicals.
        1) 1-1/2" maximum aggregate: 5.5 percent
        2) 1" maximum aggregate: 6 percent
        3) ¾" maximum aggregate: 6 percent
        4) ½" maximum aggregate: 7 percent
        5) 3/8" maximum aggregate: 7.5 percent

    b. Other Concrete:(not exposed to freezing, thawing): 2 - 4 percent air.

5. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.

F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Reinforced concrete subjected to brackish water or salt spray W/C 0.40.

G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Concrete containing HRWR admixture (superplasticizer): Not more than 9". The concrete shall arrive at the job site at a slump of 2" to 3" (3" to 4" for concrete receiving a "shake-on" hardener or lightweight concrete), be verified, then the high-range water-reducing admixture added to increase the slump to the approved level.
2. Other Concrete: Not less than 1" or more than 4".

H. Chloride Ion Level: Chloride ion content of aggregate shall be tested by the laboratory making the trial mixes. The total chloride ion content of the mix including all constituents shall not exceed the limitations set forth in Table 4.4.1 of ACI 318 for concrete subjected to deicers or exposed to chloride in service (0.15% chloride ions by weight of cement).

2.6 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce maximum mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce maximum mixing and delivery time to 60 minutes.

D. No water shall be added after mixing to concrete containing HRWR (Superplasticizer). If loss of slump occurs, the concrete treated with HRWR may be redosed as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the NPS Project Manager and the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 INSPECTION

A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.3 CONCRETE

A. Concrete shall develop the minimum compressive strengths shown on drawings at 28 days when sampled and tested in accordance with ASTM C 31 and C 39 with the maximum slump in accordance with the approved mix design.

B. Concrete shall be in accordance with the requirements and specifications of "Building Code Requirements for Structural Concrete" as modified by the building code noted above.

3.4 FORMS

A. Design formwork to maximize its reusability, reduce resources devoted to formwork construction and minimize waste generated. Where appropriate choose alternative formwork systems (refer to sections listed above).

B. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

C. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

D. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.5 VAPOR BARRIER INSTALLATION

A. Examine the condition of porous fill and remedy any unsatisfactory portions prior to installing vapor barriers.

B. Sub-base material to be per above sections.

C. Following leveling and tamping of sub-base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.

D. Lap joints 6" and seal with appropriate tape.

E. After placement of moisture barrier, cover with granular material and compact to depth as shown on drawings.

F. Avoid cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

3.6 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Epoxy-coated reinforcing bars supported from formwork shall rest on coated wire bar supports. Reinforcing bars used as support bars shall be epoxy-coated. In walls having epoxy-coated reinforcing bars, spreader bars where specified by the CO, shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing bars shall be made of corrosion-resistant material.

F. Epoxy-coated reinforcing bars shall be fastened with nylon-, epoxy-, or plastic-coated tie wire, or other acceptable materials.

G. Repair of damaged epoxy-coating: When required, damaged epoxy-coating shall be repaired with patching material conforming to ASTM A775. Repair shall be done in accordance with the patching material manufacturer's recommendations.

H. Unless permitted by the CO, epoxy-coated reinforcing bars shall not be cut in the field. When epoxy-coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material used for repair of coating damage.

3.7 JOINTS

A. Construction Joints: Locate and install construction joints as indicated, or if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to CO.

3.8 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

3.9 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

B. If form-release compound is required, coat contact surfaces of forms with a form-coating compound *before* reinforcement is placed.

C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.10 CONCRETE PLACEMENT

A. Ready-mix concrete shall comply with the requirements of ASTM C 94 and ACI 304. All plant and transporting equipment shall comply with the concrete plant standards and truck mixer and agitator standards of the National Ready Mix Concrete Association.

B. Cold weather mixing procedures shall be submitted to the NPS Project Manager for approval.

C. Notify NPS Project Manager at least 72 hours (3 regular working days) before each pour so that forms and reinforcing may be examined. Inspection will require all forms and reinforcing to be installed 24 hours prior to placing concrete unless previously approved by NPS Project Manager in writing 72 hours in advance. Do not place concrete until inspection has been made or waived.

D. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

E. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Use internal vibrators penetrating both the top and preceding layers.

G. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

H. Use and type of vibrators shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete." Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

I. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

J. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

K. Slabs: Bring slab surfaces to correct level with straightedge and strike off. Use highway straightedge, bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. See also "MONOLITHIC SLAB FINISHES" below.

L. Maintain reinforcing in proper position during concrete placement operations.

M. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

1. When air temperature has fallen to or is expected to fall below 40ºF (4ºC), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50ºF (10ºC), and not more than 80ºF (27ºC) at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Use only a non-corrosive, non-chloride accelerator. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are NOT permitted.
4. Care must be taken to store water-based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.

N. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90ºF (32ºC). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Fog spray forms, reinforcing steel and subgrade just before concrete is placed.

3.11 FINISH OF FORMED SURFACES

A. Concrete mixes containing pozzolans or slags do not set at the same rate or with the same bleed water characteristic as plain Portland cement. Therefore, attention must be directed to the proper procedures. Refer to ACI 232.2R and ACI 301.

B. Rough Form Finish: For formed concrete surface not exposed-to- view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

C. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast

concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed. Follow all requirements in ACI 301, Chapter 10 for smooth form finish. Surface preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction.

3.12 FLOOR FLATNESS/LEVELNESS TOLERANCES

A. FF defines the maximum floor curvature allowed over 24 in. Computed on the basis of successive 12 in. (300 mm) elevation differentials, FF is commonly referred to as the "Flatness F-Number".

B. FL defines the relative conformity of the floor surface to a horizontal plane as measured over a 10 ft. (3.05 m) distance commonly referred to as the "Levelness F-Number".

C. All floors shall be measured within 72 hours of being poured and in accordance with ASTM E 1155 "Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number" System (Inch-Pound Units).

1.) FF35/FL25 shall be achieved for all interior slabs except the garage, which shall be FF 20/FL 15

2.) FF20/FL15 shall be achieved for all exterior flat work except the accessible paths of travel, which shall achieve FF25/FL20

D. All slabs shall achieve the specified overall tolerance. The minimum local tolerance (1/2 bay or as designated by the CO) shall be 2/3 of the specified tolerances.

E. All elevated slabs shall achieve the specified FL tolerance before the removal of the forms.

3.13 MONOLITHIC SLAB FINISHES

A. Float Finish: Apply float finish to slabs at crawl spaces, unless otherwise noted. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system, unless otherwise noted. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance. Grind smooth surface defects, which would telegraph through applied floor covering system.

C. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, and slab surfaces which are to be covered with membrane or elastic waterproofing, or sand-bed terrazzo, and as otherwise indicated (i.e.exterior flatwork) apply single trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming. Surface preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction.

a) NOTE: 2-36” x 36” Mock ups required for NPS approval for all exposed flatwork.

D. Sealers, Hardeners and Liquid Densifiers: Apply a coat of the specified compound to all EXPOSED interior concrete floors where indicated on the drawings. This surface must be continuously moist cured by a method satisfactory to the CO. Apply and mechanically scrub compound into the floor in strict accordance with the manufacturer's printed instructions.

3.14 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
3. In order to avoid plastic or drying shrinkage cracks during warm, dry or windy weather, ACI 302 and ACI 308 shall be followed using wind breaks and sunshades when recommended. Evaporation retardant shall be as specified in Section 2.04.
4. Care must be taken to store water-based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.

B. Curing Methods: Perform curing of concrete by moisture curing, moisture-retaining cover curing, curing and sealing compound, and by combinations thereof, as herein specified.

1. Provide moisture curing by following methods.

    a. Keep concrete surface continuously wet by covering with water.
    b. Continuous water-fog spray.
    c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:

    a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide curing and sealing compound to exposed interior slabs not receiving additional flooring. A clear curing and sealing compound shall be used on exterior slabs, sidewalks and curbs not receiving a penetrating sealer.
4. Use the specified curing compound on surfaces to be covered with finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, damp proofing, membrane roofing, flooring, painting, and other coatings and finish materials. Apply compound in accordance with manufacturer's direction.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of the specified curing compound or a continuous moist curing method approved by the CO.

E. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F710, coordination with flooring manufacturer is required to ensure concrete coatings will not obstruct the bond between the concrete and the adhesive. In addition, ensure coatings and adhesives are "benignly compatible" -- in other words, do not combine substances whose constituents are reactive.

F. Sealer and Dust proofer: Apply a second coat of the specified curing and sealing compound to exposed interior slabs not subjected to vehicular traffic, noted on the drawings. These slabs must have received an initial coat of the curing and sealing compound.

3.15 REMOVAL OF FORMS

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 12 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28-days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.16 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and

cure concrete as herein specified, to blend with in- place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.17 CONCRETE SURFACE REPAIRS

A. Prior to all repairs, an as-built condition sketch and method of repair must be submitted to the NPS PROJECT MANAGERfor review and approval.

B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to CO.

3.18 WORK IN CONNECTION WITH OTHER TRADES AND CONTRACTS

A. Sleeves, pockets, openings, etc., shall be set in the concrete as required for the Mechanical, Electrical and Plumbing (MEP) trades.

B. Coordinate all penetrations, cutting, and patching with waterproofing contractor.

3.19 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Contractor will employ a testing laboratory to perform tests and to submit test reports.

B. Provide special inspections per the applicable Building Code and the requirements of all applicable ACI standards.

C. Sampling and testing for quality control during placement of concrete may include the following, as directed by CO.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
2. Slump: ASTM C 143; one test at point of discharge for each truck; additional tests when concrete consistency seems to have changed.
3. Air Content: ASTM C 173, volumetric method for normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each truck of air-entrained concrete.
4. Concrete Temperature: Test hourly when air temperature is 40ºF (4ºC) and below, and when 80ºF (27ºC) and above; and each time a set of compression test specimens made.

5. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
6. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 25 cu. yds. plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimens tested at 7 days, three specimens tested at 28 days, and one specimens retained in reserve for later testing if required.

    a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
    b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
    c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

7. Water Cementitious Ratio Test: Check water content of concrete in accordance with AASHTO T 318 “Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying”. Frequency of this test shall be the same as that of compressive strength tests, noted above.
8. Test results will be reported in writing to NPS Project Manager within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

    a. Non-Compliance: All test reports indicating non-compliance shall be transmitted immediately to all parties on the test report distribution list and the hard copies submitted on different colored paper.
    b. Nondestructive Testing: Windsor probes, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

9. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by CO. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

3.20 WASTE MANAGEMENT

A. Separate and recycle waste materials in accordance with Division 01 to the maximum extent feasible.

B. Collect cut off steel and discarded reinforcement steel and place in area for recycling.

END OF SECTION

SECTION 03 39 00 - CONCRETE CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Initial and final curing of horizontal and vertical concrete surfaces.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components associated with construction.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 302.1 - Guide to Concrete Floor and Slab Construction.
3. ACI 308.1 - Specification for Curing Concrete.
4. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

B. ASTM International:

1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

C. Section 013300 - Submittal Procedures: Requirements for submittals.

1.3 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

1.4 QUALITY ASSURANCE

A. Perform Work according to ACI 301 and 318

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. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

2.2 MATERIALS

A. Membrane-Curing Compound:

1. Comply with ASTM C1315, Type I, Class A.

B. Water: Potable; not detrimental to concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for application examination.

B. Verify that substrate surfaces are ready to be cured.

3.2 APPLICATION

A. Horizontal Surfaces:

1. Comply with ACI 308.1.
2. Spraying: Spray water over floor slab areas and maintain wet for seven days.

3. Absorptive Mat:

a. Saturate burlap-PE and place burlap-side down over floor slab areas.
b. Lap ends and sides.
c. Maintain in place for seven days.

B. Vertical Surfaces:

1. Comply with ACI 308.1.
2. Membrane-Curing Compound: Apply compound in two coats with second coat applied at right angles to first.

3.3 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not permit traffic over unprotected floor surfaces.

3.4 ATTACHMENTS

A. Storage Area Slabs:

1. Description: Absorptive mats.
2. Type: Burlap-PE.

B. Retaining Walls:

1. Description: Membrane-curing compound.
2. Type: Acrylic.
3. Color: Clear.

C. Concrete Pavement:

1. Description: Membrane-curing compound.
2. Color: Opaque.

D. Other Floor Areas:

1. Description: Membrane-curing compound.
2. Type: Acrylic.
3. Color: Translucent.

END OF SECTION 03 39 00

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Furnish and deliver for installation by others, anchor bolts, bearing plates and any other miscellaneous steel with complete instructions and templates to facilitate installation.
2. Furnish and erect columns, bearing plates, beams, girders, hangers and all related connections (bolted and welded).
3. Openings (unreinforced and reinforced) in structural steel to accommodate mechanical and electrical work.
4. Shop painting and field touch-up painting.
5. Erection bracing and supports, including steel wedges, shims or nuts required for leveling base plates.
6. Angles attached to structural steel as shown on drawings.
7. Unless specifically excluded, furnish and install all other items for structural steel work indicated on the drawings, specified, or obviously needed to make the work of this Section complete.
8. Waste Management

B. Related Requirements:

1. Division 01 Section “Construction Waste Management and Disposal”
2. Division 03 Section “Cast in Place Concrete”
3. Division 07 Section “Waterproofing.”
4. Division 07 Section “Joint Sealants.”

C. Related Work Specified Elsewhere

1. Installation of anchor bolts furnished under this section.
2. Grout under base and bearing plates.
3. Miscellaneous metal work.
4. Stair framing and hangers.
5. Field painting of structural steel, except as specified herein.
6. Fireproofing systems.

1.3 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of all connections required by the drawings to be completed by structural steel fabricator (including comprehensive engineering analysis by a qualified professional engineer) to withstand loads indicated and comply with other information and restrictions indicated, unless noted otherwise.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use design method indicated on structural drawings.
3. Moment Connections: Fully restrained unless otherwise noted on drawings.

B. Lateral Force Resisting System: Type used is indicated on structural drawings.

1.4 SUBMITTALS

A. Product Data: Submit data for each type of product indicated in the contract documents.

B. Shop Drawings: Submit shop drawings in accordance with the specifications as follows:

1. Clearly show all work, including relationship of structural steel members and embedded bolts, base plates or other similar items to the adjacent work of reinforcing steel in Foundations, Slabs or Grade Beams and with significant lines of finishes of other trades.
2. Do not fabricate or deliver work to the site before drawings reviewed by the NPS Project Manager/COR have been returned.
3. Before preparing steel shop drawings, submit proposed submittal schedule for review by NPS Project Manager/COR.
4. Before preparing steel shop drawings, submit for review a set of job standards showing all necessary joint details with full particulars of connection pieces, shop and field welds, and holes for erection bolts and permanent bolts. These shall include any moment and shear connections. Appropriate marks for designating all types and sizes of joint details shall be included. After approval of these job standards, the erection plans are to be submitted and shall be marked to indicate unmistakably the type and size of joint to be used for every beam connection. Do not order steel in advance of approval of the job standards and the erection plans with joint marks, except at own risk
5. Prepare remainder of steel shop drawings after approval of job standards and erection plans. Drawings submitted prior to approval of job standards will be returned without review.
6. Prepare shop drawings in conformance with the applicable procedures shown in "*Detailing for Steel Construction*," latest edition, published by AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed in California. During the preparation of shop drawings, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents.
7. Clearly indicate the size and grade of steel for each component. Identify rolled shapes, tubes and plates by using the standard designations used in "Steel Construction Manual" Latest Edition, by AISC.
8. Indicate welds by using the symbols conforming to AWS A2.4 "Symbols for Welding and Nondestructive Testing." Where necessary for clarity, indicate welding procedure designations or other data in the tail of the welding symbol.
9. Show explicitly the type of connection used in each location, including the grade, size, and number of bolts; the type, number, position, designation and orientation of each washer; and the size of each hole, whether slotted or round. Ensure that adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences where applicable and necessary.
10. Show holes required for securing work specified in other sections to structural steelwork, as well as all holes required for passage through structural steelwork of work of other trades. Provide field work drawings for all such holes not shown in shop or erection drawings. Addition of or change in size or location of openings will not be permitted without prior approval.
11. Use bolted connections wherever possible; avoid field welding unless prior approval has been obtained by the NPS Project Manager / COR.
12. Make details in such a way as to avoid having steel, connections, bracing, bolts, etc., interfere with architectural details or in any way reduce the areas of shafts, openings, clearances, etc.
13. Detail and schedule cleaning and painting data and requirements, including specific indication of "no-paint" areas.
14. Clearly show the size and location of each member and the erection mark assigned to each member.

Show each field connection with all data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.

15. Prepare, keep up to date, and submit a complete drawing index cross referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to any agreed shop drawing review schedule.
16. Prepare anchor bolt and base plate erection drawings containing complete location and placing details, including details of all templates. Provide erection drawings for anchor bolt and other embedded components to the concrete trade in advance of applicable concrete work and in coordination with concrete and reinforcing steel construction sequence.
17. Submit, in writing, any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor's letterhead. Deviations not identified or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient cause for the NPS Project Manager/COR to return each shop drawing containing such deviations without further action. Acceptance of shop drawings containing deviations not detected by the NPS Project Manager/COR during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.
18. Prior to resubmission of shop drawings with additions or corrections, circle or bubble and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.
19. Prior to making shop drawings for any portion of the work involving alterations to an existing structure, make all necessary field observations, measurements and surveys of existing conditions.

C. Submit certified copies of each survey conducted by a surveyor licensed in California and employed by the structural steel subcontractor. Survey shall show elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and Contract Documents.

D. Reports:

1. Submit certified copies of mill test reports for all steel furnished. Perform mechanical and chemical tests for all material regardless of thickness or use.
2. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
3. Submit anchor bolt checking certification as required.
4. Submit qualification certificates of all welders who will perform work on the project.
5. Submit survey of erected steelwork as required.

E. Submit verification of bio-degradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.

1.5 QUALITY ASSURANCE

A. Except as modified by this specification, comply with the applicable provisions and recommendations of the following codes and standards:

1. International Building Code, 2021
2. AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".
3. AISC "Code of Standard Practice for Steel Buildings and Bridges" latest edition.

4. AISC “Seismic Provisions for Structural Steel Buildings”, latest edition.
5. Industrial Fasteners Institute "Handbook of Bolt and Bolted Joints" latest edition.
6. RCSC "Specifications for Structural Joints Using High-Strength Bolts."
7. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
8. AWS D1.1, "Structural Welding Code."
9. AWS A5.18 & A5.28, Structural Welding Code for GMAW
10. SSPC "Painting Manual, Volume 2, Systems and Specifications.", Latest edition.

B. Qualifications for welding work shall be as follows:

1. Qualify welding procedures and welding operators in accordance with the AWS "Standard Qualification Procedure."

    a. Include amended requirements of the building code as noted above.

2. Submit certification that all welders to be employed in work are AWS qualified. If re-certification of welders is required, retesting will be responsibility of structural steel subcontractor.

    a. Include licensing requirements as per the building code noted above and local jurisdiction.

1.6 TESTING AND INSPECTION

A. Special Inspection as required by the applicable Building Code of all structural steelwork in the shop and field will be performed by an inspection agency retained by the Contractor at no expense to the Owner. The inspection agency shall work under the direction of the Contractor. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in both shop and field with at least ten days' written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.
3. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
4. Information as to time and place of all rollings and shipment of material to shops.
5. Representative sample pieces as requested by the testing agency.
6. Full and ample means and assistance for testing all material.
7. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.

B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.

C. The following minimum criteria shall be adhered to in testing of welds and bolts:

1. All welds and bolts shall be examined by visual means.
2. 25% of all welds, selected randomly, shall be measured.
3. Bolted joints shall be verified per the RCSC “Specification for Structural Joints Using High-Strength Bolts,” Section 9, based on installation method.
4. All welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
5. 10% of all manual fillet welds shall be tested by the magnetic particle method.
6. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
7. 100% of groove welds shall be tested by the ultrasonic method.

D. Shop inspection will include examination of steel for straightness and alignment, fissures, mill scale, and

other defects and deformities, as described in ASTM A6, examination of fabricated pieces for conforming to approved shop drawings, testing of bolts and welds, and inspection of shop painting. All shop welds shall be visually inspected, and spot tested using Ultrasonic Method ASTM E 114 and AWS, Chapter 6, Part C. All inspected welds shall be identified by the inspector.

E. Field inspection will include examination of erected steel for welding, proper fitting and tensioning of bolts, alignment, trueness and plumbness, touching up of shop coat, level of billets and base plates.

F. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:

1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the COR.
3. The testing agency shall be prepared to utilize the following approved methods of testing:

    a. Liquid penetrant inspection: ASTM E 165.
    b. Magnetic particle: ASTM E 1444.
    c. Radiographic inspection: ASTM E 94 and E 1032.
    d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.

G. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect has been located. No further work shall be done on the assembly or subassembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the NPS Project Manager/COR. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the NPS Project Manager/ COR.

H. Apparatus and procedures for measuring required tension in pretensioned and slip-critical high strength bolted connections shall be furnished and maintained by the steel contractor, in accordance with the RCSC "Specification for Structural Joints Using High-Strength Bolts," and shall be approved by the inspection agency. The inspection agency shall observe the pre-installation verification testing required and shall ensure by routine observation that the bolted installations conform to the approved pretensioning method being used. The steel contractor shall provide a laborer and scaffolding as required for the testing of connections by the inspection agency, and shall, at his own expense, furnish such facilities and provide such assistance as may be required for proper inspection.

I. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.

J. Inspection of Shop Painting: Contractor to provide inspection of coatings installation by Manufacturers Representative or NACE certified inspector to confirm in writing that Manufacturers' warranty requirements have been met and verify the following:

1. Visually evaluate surface preparation by comparison with pictorial standards in accordance with SSPC-Vis 1.
2. Measure dry film thickness of each coat with a magnetic film thickness gauge in accordance with SSPC-PA 2.
3. Visually inspect dried film for runs, sags, dry spray, overspray and missed areas.
4. Repair defective or damaged areas in accordance with painting requirements specified. Architecturally exposed structural steel shall be free of runs and holidays. Make repairs to shop or field coat as directed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. Minimize the disturbances to site and soil conditions.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration, discoloration or staining.

D. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

1.8 PROJECT CONDITIONS

A. The structural steel contractor shall coordinate the structural steel work with the work of other Contracts. Verify all dimensions and details of this Contract and those of other Contracts that affect the work before proceeding. Any discrepancies shall be immediately reported to the COR.

B. Be fully responsible for the accurate installation of the work. Any discrepancy which arises from the failure to execute the work in conformity to the drawings and specifications shall be properly remedied at the contractor's own expense and in a manner acceptable to the COR.

C. Locate dimensionally on setting plans all anchor bolts, inserts, bearing and base plates, etc., and prepare and deliver all required templates and fully dimensioned setting plans in time for the proper execution of the work. Anchor bolts shall be set by another subcontractor. The structural steel contractor shall check all such settings for correctness after they have been cast in place, and before proceeding with erection work.

D. Report to the COR and certify compliance with the above checking requirements in writing and indicate any inaccuracies found in the location of anchor bolts or inserts, and corrections which must be made to their installation. Any inaccuracies not included in the report and found during or after steel erection shall be the responsibility of the structural steel contractor and the cost of corrective measures shall be borne by the structural steel contractor.

E. Use base lines, bench marks, or other standards for survey work that have been provided or verified by others. If permanent building bench marks have been established, these will be used for field checking.

F. Coordinate with all other trades to ensure that work of this section does not cause undue conflict. Ensure that location of erection devices such as cranes, derricks, booms or hoists, does not cause over-stresses to steel frame to work previously placed by other trades or to existing structures. When required, retain the services of a licensed professional engineer to ascertain that erection devices do not create unsafe conditions or cause overstresses.

G. Ensure full co-ordination with other related trades and professions.

1.9 SUBSTITUTION

A. COR reserves the right to require substitute shapes of other sizes than those indicated on the drawings when it is apparent that the shapes specified cannot be furnished within the time required for the progress of construction. Make said substitutions without additional cost to the owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel shapes, including structural steel wide flange and structural tee rolled shapes, channels, angles, plates, pipe, and hollow structural sections: As noted on structural drawings.

B. High Strength Bolts: As noted on Structural Drawings.

C. Anchor Rods: As noted on structural drawings

D. Filler metal for welding electrodes. As noted on structural drawings.

E. Structural steel paint for exposed members: Painting of galvanized steel is anticipated at Lantern, the product shall be NPS approved epoxy primer and finish coatings appropriate for exterior application and compatible over galvanized metal surfaces. Submit product data and physical representative sample for review and approval by the COR with shop drawings.

F. SEE SECTIONS 3.3, 3.5 & 3.10 FOR FURTHER REQUIREMENTS ON SUBMITTALS AND SPECIAL INSPECTIONS

PART 3 - EXECUTION

3.1 FABRICATION

A. All shop connections shall be high strength bolted unless specifically shown otherwise. Fabricate work in shop in as large assemblies as practicable. Use welded connections ONLY where shown on drawings. If a bolted connection is not possible, obtain written approval from the COR for the welded connection.

B. Camber: As indicated on drawings.

C. Mill column ends and bearing stiffeners to give full bearing over the cross section. Plane contact surfaces of bearing plates when required by the AISC Specifications. It is not necessary to plane bottom surfaces of plates on grout beds.

D. Drill or punch holes at right angles to the surface of the metal, not more than 1/16" larger than the connector diameter. Do not make or enlarge holes by burning. Drill material having a thickness in excess of the connector diameter and material thicker than 7/8". Holes shall be clean-cut without torn or ragged edges. Remove outside burrs resulting from drilling operations.

E. Provide holes in members to permit connection of the work of other trades. Use suitable templates for proper location of these holes. Steel requiring adjustment or accurate alignment shall be provided with slotted holes or full bearing shims as shown.

F. Provide holes, slots and openings required by other trades together with necessary reinforcing required. Use suitable templates for proper location of these openings. All such openings shall be shown on the shop drawings. No change in size or location will be permitted without prior approval.

G. Manual flame cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is within 1/8" of the required line.

3.2 SHOP CONNECTIONS

A. Provide connections as shown on the drawing exactly as detailed. Where connections are not detailed, the minimum connections shall comply with appropriate tables headed, "Framed Beam Connections" shown in the AISC "Manual of Steel Construction" unless otherwise noted on the drawings. Use high strength bolts unless otherwise shown.

B. Do not use welded connections unless shown on details. In an effort to preserve galvanized coatings integrity and to better withstand harsh marine environmental conditions, Field welding is not allowed without written instruction from the COR.

C. Bolting

1. Bolts shall be of a length that will extend not less than 1/4" beyond the nuts. Enter bolts into holes without damaging the thread.
2. Joint Type: As noted on the Structural Drawings.
3. Make high-strength bolted joints without the use of erection bolts. Bolt heads and nuts shall rest squarely against the metal. Where structural members have sloping surface, bolted connections shall be provided with beveled washers to afford square seating or framing for bolt heads or nuts.
4. All joints are to be compacted to the snug-tight condition in accordance with Section 8 of the RCSC “Specification for Structural Joints Using High-Strength Bolts.” Protect bolt heads and threads from damage during installation.
5. Pretensioned and slip-crtical joints are to be installed by one of the methods prescribed in Section 8.2 of the RCSC “Specification for Structural Joints Using High-Strength Bolts,” unless written approval is obtained from the COR.
6. Bolts that have been completely tightened shall be marked for identification.

D. Welding

1. The following environmentally preferable welding processes shall be used as described for the related application without exception:

    a. Submerged Arc Welding (SAW): Plate girders, fillet and butt joints in pipes, cylinders, columns and beams, and welds where ‘downhand’ or horizontal positions are possible.
    b. Gas Metal Arc Welding (GMAW) shall be used where SAW is not applicable (such as for angled connections and anything irregular or short).
    c. Field welding shall be allowed only in special circumstances; as prior approved by COR in such cases Flux Core Arc welding (FCAW) shall be specified

2. Do not begin structural welding until joint elements are inspected for surface preparation, fit-up, and cleanliness of surface to be welded and are then bolted or tacked in intimate contact and adjusted to dimensions shown on drawings, or both, with allowance for any weld shrinkage that is expected. No members are to be spliced without prior approval by the COR.

    a. Containment surface preparation debris must meet SSPC-Guide 6 guidelines.

3. Pre-heat and interpass temperature shall be in accordance with Table 4.2 (including footnotes) of the AWS Code for Welding in Building Construction. The temperature shall be measured from the side opposite to that which the pre-heat is applied, where possible.
4. All groove welds shall be continuous and full penetration welds unless otherwise shown on the design drawings. Welds made without the aid of a back-up bar shall have their roots chipped, ground or roughened out to sound metal from the second side, before welding is done from the second side.
5. All welds shall be sound throughout. There shall be no crack in any weld or weld pass. Weld may be considered sound if it contains only slight porosity or fusion defects which are well dispersed.
6. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The

surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.

3.3 SHOP PAINTING AND CLEANING

A. Finishing, coating, plating

1. Shop painting and factory finishing shall be preferred to field painting whenever possible.

a) Field painting, coating, plating must be approved in advance by the COR, Provide written plan describing proposed location and justification for relief from shop or factory finishing. Provide description of application as per manufacturer's directions including third party inspection by manufacturers representative.

B. Remove all rust, scale, grease and other detrimental foreign matter in accordance with SSPC-SP 3, Power Tool Cleaning, unless conditions/opportunities listed below apply.

1. Use surface preparation classification recommended by paint manufacturer, SSPC or Master Painters Institute (MPI) for paint product used.

a. SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations, must be followed for all applicable surface preparation techniques.

C. Immediately after surface preparation, apply structural steel primer paint where specified, in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces. Use type of primer paint as specified in "Materials" article above. Apply three coats to surfaces that will be inaccessible after erection

D. Paint all structural steel in accordance with the foregoing specification, except as follows:

1. Steel which is to receive spray-on fireproofing.
2. Interior galvanized steel
3. Within 2" of field welds or welds made after paint is applied.
4. Faying surfaces in bolted connections shall be prepared per Section 3.2 of the RCSC "Specification for Structural Joints Using High-Strength Bolts."
5. Machined surfaces and threaded parts required for adjustment of the structure. Protect these with suitable rust inhibiting coating which may be removed after final installation of the work so that proper finished coatings may be applied.

3.4 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

3.5 SOURCE QUALITY CONTROL

A. Refer to testing and inspection requirements specified above.

B. Site conditions dictate an elevated standard of care to be performed by all trades to prevent corrosion of steel, including pre-approved third party certified inspection of shop applied galvanized coatings, field applied repairs to galvanized coatings as well as shop and field applied coatings of painted surfaces.

3.6 EXAMINATION

A. Verify field measurements prior to start of erection. Check the alignment and elevation of all column supports and location of all anchor bolts with transit and level instruments before starting erection. Notify COR of any errors. Obtain COR's approval of methods proposed for correcting errors prior to proceeding with corrections and erection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 PREPARATION

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

3.8 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

C. Column billets and bearing plates shall be supported and aligned on steel wedges, shims, or leveling nuts. After the supported members have been plumbed and properly positioned by instrument and anchor nuts tightened, the entire bearing area under the plate shall be packed solidly with grout specified in another Section. Wedges and shims shall be set back a minimum of 3/4" from the edges of plates and shall be left in place. Leveling plates are not permitted.

D. Plumbing, Leveling and Bracing

1. Structural steel shall be erected true and level, and temporary bracing shall be introduced wherever necessary to provide for all construction loads to which the structure may be subjected, including equipment and the operation thereof. Such bracing shall be left in place as long as may be required for safety. No welding shall be done or bolts drawn up tight until structural steel has been properly aligned. Obtain approval for guy locations to assure lack of interference with operations of other trades.

E. Drifting

1. Light drifting necessary to draw holes together will be permitted, but drifting of unfair holes will not be permitted. Twist drills shall be used to enlarge holes as necessary to the next larger size; use next larger size bolts as required. Reaming that weakens the members or make it impossible to fill the holes properly or to adjust accurately after reaming, will not be allowed.

3.9 FIELD CONNECTIONS

A. In addition to the requirements for shop connections comply with the following:

1. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
2. Joint Type: As noted on structural drawings.

B. Weld Connections: Only as approved in advance by COR. Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

3.10 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780. Excepting no zinc rich painting for repairs as described in ASTM 780 is allowed.

1) All repairs to galvanized coating shall be progress inspected by an independent third party special inspector trained or certified by the ICC, AISC or the American Galvanizers Association.
2) Submit certification credentials for COR approval with shop drawings.

B. Touchup Painting: Immediately after any damages, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 3, Power Tool Cleaning or per manufacturers recommendation for coatings in harsh coastal environments, which ever is deemed most appropriate by the CO.
2. Submit all areas of proposed touch up with proposed materials with methods for application and third party inspection to COR for approval with shop drawing submittal.
3. All touch up repairs to be progress inspected by ICC certified or other proposed third party coatings inspector approved by the COR. Submit inspector credentials for COR approval with shop drawing submittal.

C. Immediately after damages are incurred, as per 3.10. A & B, all damaged areas in shop coat, exposed surfaces of bolt heads, nuts and washers, and all field welds and unpainted areas adjacent to field welds and high strength bolts shall be painted with a "touchup" application of same paint used in the shop coat and then painted with same paint used for shop coat tinted another color. Retouch in field, any scraped, abraded, and unpainted surfaces. Painting shall be as specified for shop coats.

D. Structural steel which is to support mechanical equipment and will be left exposed to the weather in the finished project shall be 316 stainless steel or with prior approval of COR,field painted with anti-corrosive paint as described in Part 2 for Paint Materials. Submit request for COR approval with shop drawing submittals for structural steel and mechanical shop drawings.

3.11 WASTE MANAGEMENT

A. Separate and recycle waste materials in accordance with Division 01 to the maximum extent feasible.

B. Collect all metal cut-offs and scraps and separate for recycling. Place the following metal waste in designated containers in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.

END OF SECTION 051200

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Removable cane rail under stair on first floor.
5. Miscellaneous steel trim.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for steel framing, supports, and other steel items attached to the structural-steel framing.

1.2 COORDINATION

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

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Manufactured metal ladders.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Removable cane rail under stair on first floor, including sleeved base.
2. Metal ladder.

1.4 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 METALS

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. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 316L.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316L.

E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use.

B. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts,

ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 2.

C. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

D. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

E. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Alloy Group 2 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

F. Slotted-Channel Inserts: Stainless Steel (Type 316) ASTM A240 w/316 Stainless accessories, nuts, bolts, washers.

2.3 MISCELLANEOUS MATERIALS

A. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.4 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 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.

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

G. Fabricate seams and other connections that are 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.

J. 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.

2.5 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.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

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

2.6 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c. unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.

B. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fixfast USA
   b. Halliday Products
   c. O'Keeffe's Inc.
   d. Precision Ladders, LLC
   e. Royalite Manufacturing, Inc.
   f. Or Approved Equal

2. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
3. Space siderails 18 inches apart unless otherwise indicated.
4. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
5. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
6. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.
8. Provide minimum 72-inch- high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.8 REMOVABLE CANE RAIL

A. Post bases shall be recessed or surface mounted stainless steel sleeves to permit railing to be removed when water heater needs to be replaced.

1. Shop drawings to specify base design and number of removable sections.
2. Contractor to coordinate recessed sleeves with concrete slab work

B. Construction: 316 Stainless Steel, 2 in. dia. pipe, fully welded, filed smooth.

1. Finish: 180-Grit Polished Finish: Uniform, directionally textured finish.

2.9 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.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Miscellaneous steel trim shall be 316 stainless steel.

2.10 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 no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and

Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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 screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF 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 overhead doors securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction with through bolts.

D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

E. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.5 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.6 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

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SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe and tube railings for Accessible Ramp & Stairs to Beach.
   2. Bid Option H: Provide 316 Stainless Steel

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

   1. Manufacturer's product lines of mechanically connected railings.
   2. Railing brackets.
   3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, weld details, and attachment details to other work.

C. Samples: Railing Splice Joint and Handrail attachment bracket

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

   1. Handrails:

      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
      d. No Post-installed concrete anchors allowed.

      e. No field welding allowed. Shop fabricate all assemblies so as to allow for all hot dipped galvanizing treatment before installation.

f. No repairs with Zinc rich paints or Primers allowed. Utilize hot melt procedure using zinc-based solders as per ASTM A780 (applied at 480°F–670°F) The final coating thickness for this repair shall meet the specification requirement for the material category of the steel part being repaired with a minimum thickness of 4 mils (100 µm). The thickness shall be measured by any of the methods in A123/A123M that are nondestructive. Zinc-based solder products shall closely match the surrounding zinc and blend in well with the existing coating appearance. In progress repairs and finished product to inspected and approved by third party AWS certified inspector as approved by the NPS Project Manager/COR

2.2 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 STEEL AND IRON

A. Tubing: ASTM A500 (cold formed).

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide hot dip galvanized finish for all exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

2.4 STAINLESS STEEL (per Bid Option H)

A. Tubing: ASTM A554, Grade MT 316L.

B. Pipe: ASTM A312/A312M, Grade TP 316L.

C. Castings: ASTM A743/A743M, Grade CF 8M or CF 3M.

D. Plate and Sheet: ASTM A240/A240M or ASTM A666, Type 316L.

2.5 FASTENERS

A. General: Provide the following:

Galvanized or Stainless Steel Railings:
1. Type 316 stainless-steel fasteners.

2. Post-Installed Anchors: No Post-Installed Expansion or similar allowed, wet set anchors only, embedded in concrete, laid out correctly to correspond with approved shop drawing dimensioned location before pouring concrete.

2.6 MISCELLANEOUS MATERIALS

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

2.7 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

E. Form changes in direction by bending or by inserting prefabricated elbow fittings.

F. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:
1. Hot-dip galvanize exterior steel railings after fabrication. Comply with ASTM A123/A123M for hot-dip galvanized railings.

2.9 STAINLESS-STEEL FINISHES

A. Stainless Steel Tubing Finishes:

1. 180-Grit Polished Finish: Uniform, directionally textured finish.

B. Stainless Steel Sheet and Plate Finishes:

1. Directional Satin Finish: ASTM A489/A480, No. 4

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. No Field welding is allowed. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after shop fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

END OF SECTION 055213

SECTION 05 71 13 - FABRICATED METAL SPIRAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Fabricated metal spiral stairs with steel central-supporting columns, radiating treads, and railings.
2. Anti-slip tread step covers for both the spiral stair and the wood stair from first to second floor.

B. Related Requirements:

1. Section 05 12 00 “Steel Structure” for adjacent structure.
2. Section 05 50 00 "Metal Fabrications" for miscellaneous metal components.
3. Section 06 10 00 “Rough Carpentry” for attachments to structure.

1.2 COORDINATION

A. Coordinate installation of anchorages for fabricated metal spiral stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, anchor bolts, and items with integral anchors, that are to be fastened to surrounding wood and steel structure. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For fabricated metal spiral stairs, including railings. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for components.

B. Shop Drawings: For fabricated metal spiral stairs and railings. Include plans, elevations, sections, details, attachments to other work, and field measurements.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For the following products, in manufacturer's standard sizes:

1. Treads.
2. Anti-slip tread covers
3. Metal with anodized finish.
4. Railing members.

E. Delegated Design Submittal: For fabricated metal spiral stairs and spiral stair railings, including analysis data signed and sealed by the qualified professional engineer

responsible for their preparation.

F. Protection Plan for Spiral Stair Treads, Rails & Balusters during construction

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with fabricated metal spiral stairs by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain fabricated metal spiral stairs from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fabricated metal spiral stairs and railings.

B. Structural Performance of Stairs: Fabricated metal spiral stairs are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7, structural parameters/requirements identified on structural drawings:

1. Uniform and concentrated loads need not be assumed to act concurrently.

2. Railing Loads: Stairs are to withstand stresses resulting from railing loads in addition to loads specified above.
3. Deflection: Limit deflection of treads, landings, and framing members to L/360 but not to exceed 1/4 inch.

C. Structural Performance of Railings: Railings are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7, structural parameters/requirements identified on structural drawings:

D. Seismic Performance: Fabricated metal spiral stairs are to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, structural parameters/requirements identified on structural drawings.

2.3 SPIRAL STAIRS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Boston Stair
2. Duvinage LLC
3. Mylen Stairs
4. Salter Spiral Stair
5. Stairways Inc.
6. Or Approved Equal

B. Center Column: Aluminum pipe welded to baseplate for anchorage to floor structure. Brace column at upper floors by means of landings attached to column and floor structure unless otherwise indicated. Provide cap for column if top is exposed.

C. Treads, Formed Metal Plate: Formed aluminum-plate treads and platforms, welded to hubs or center column, and as follows:

1. One-piece treads and risers, with legs.
2. Aluminum-alloy, rolled tread-plate wearing surfaces.
3. Aluminum checker plate tread.

D. Railings: Uniformly bent to spiral shape and continuing at top to form guardrail around floor opening.

1. Guardrail at top shall be supported by posts attached to the landing and floor assemblies. The wall assemblies are not suitable for attachment unless dedicated blocking is coordinated by the Contractor.
2. Balusters and intermediate rails shall comply with commercial spiral stair requirements per the current IBC.
3. Space intermediate rails less than 4 inches, clear.
4. Locate bottom rail so that a 6-inch- diameter sphere cannot pass between the stair and rail.
5. Balusters and intermediate rails shall be extruded aluminum.
6. Hand Rail:

a. 1-1/4- to 2-inch- OD round aluminum tubing.

7. Top Rail:

a. 1-1/4- to 2-inch- OD round aluminum tubing.

E. Tread Accessories:

1. Hi-Traction Anti-Slip Step Covers.

a. Manufacturers: Provide products by one of the following:

1) Safeguard Technology
2) Safety Grip Solutions
3) Or Approved Equal

b. Salient characteristics:

1) Primary materials: FRP (fiber reinforced plastic) and Isophthalic polyester resins.
2) Surface Grade: Fine
3) Grit size: 2 mm (1/16")
4) Manufacturer provided fasteners
5) Approved for a marine environment
6) Two color with High contrast nosing color
7) Color to be selected by Contracting Officer from manufacturer's standard color selection.
8) No photoluminescence.
9) Friction test (Coefficient of Friction) = 0.75 – 0.85

2.4 MATERIALS

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported item unless otherwise indicated.

C. Aluminum Sheet and Plate: ASTM B209, Alloy 6061-T6.

D. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

E. Aluminum Pipe and Structural Round Tubing: ASTM B429/B429M, Alloy 6063-T6.

F. Extruded-Aluminum Tubing: ASTM B221, Alloy 6063-T5/T52.

G. Aluminum Castings: ASTM B26/B26M, Alloy 319.0-F.

2.5 FABRICATION

A. Assemble fabricated metal spiral stairs in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

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 work true to line and level with accurate angles and surfaces.

D. Fabricate connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

E. Cut, reinforce, drill, and tap as needed to receive hardware, screws, and similar items.

F. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. Finish exposed welds to comply with NOMMA Guideline 1, "Joint Finishes," for Finish #1 -No evidence of a welded joint.
5. Finish exposed surfaces smooth and blended and, except for fillet welds, so welded surface matches contours of adjoining surfaces.

G. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where needed for securing fabricated metal spiral stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, wood screws, and other connectors as required.

B. Assemble fabricated metal spiral stair components to comply with manufacturer's written instructions, with each component aligned and in correct relation to each other, securely anchored to supporting column and adjacent structure.

C. Do not cut, alter, or drill stair components in the field that do not fit properly. Return

components that do not fit to manufacturer for adjustment.

D. Install fabricated metal spiral stairs accurately in location, alignment, and elevation; level and plumb; and in accordance with manufacturer's written instructions.

E. Fastening shall be bolted. No welding.

3.2 PROTECTION

A. Protect finished tread surfaces during construction by covering them with 1/2-inch-thick, plywood secured with plastic strapping or another nonmarring fastening method.

1) Submit Protection Plan for rails, blusters and other Spiral Stair components for COR approval with shop drawing submittal

END OF SECTION 05 71 13

SECTION 05 73 00 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel decorative railings.

a. At top walkway of lifeguard tower.
b. At interior stair between first and second floor.

B. Related Requirements:

1. Section 05 12 00 "Structural Steel" for attachments to structure.
2. Section 06 10 00 "Rough Carpentry" for wood blocking for anchoring railings and structural portions of stair between first and second floor.
3. Section 06 20 23 "Interior Finish Carpentry" for wood elements of stair between first and second floor.
4. Section 07 21 00 “Thermal Insulation” for closed cell foam insulation in the exterior posts.

1.2 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. 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 items to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

Lantern Exterior Railings:

1. General Contractor.
2. COR/NPS Project Manager
3. Railing Fabricator & Installer
4. Parapet Cap Fabricator
5. Deck Membrane Fabriator & Installer

Interior Stair Railings:

B. General Contractor.
C. Railing Fabricator & Installer
D. Stair Builder

E. NPS Project manager(s)

1.4 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of decorative metal railings assembled from standard components.
2. Stainless steel cable and cable fittings.
3. Fasteners.
4. Post-installed anchors.
5. Handrail brackets.
6. Nonshrink, nonmetallic grout.
7. Anchoring cement.
8. Metal finishes.

B. Shop Drawings: Include plans, elevations, sections, weld types and finishes, waterproofing attachment details.

C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

D. Samples for Verification: For each type of exposed weld and mechanical finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters
2. Cable and cable hardware and connections.

1.5 INFORMATIONAL SUBMITTALS

Qualification Data: For delegated design professional engineer.

A. Qualify welding procedures and welding operators in accordance with the AWS "Standard Qualification Procedure."

B. Include amended requirements of the building code as noted above.

C. Submit certification that all welders to be employed in work are AWS qualified. If re-certification of welders is required, retesting will be responsibility of subcontractor.

D. Include licensing requirements as per the building code noted above and local jurisdiction.

E. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

F. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.3 STAINLESS STEEL DECORATIVE RAILINGS

A. Stainless Steel Decorative Railings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AGS Stainless Inc.
    b. Atlantis Rail Systems
    c. Greco; CSW Industrials Inc.
    d. HDI Railings
    e. Or Approved Equal

B. Tubing: ASTM A269/A269M, ASTM A554, Grade MT 316L.

C. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 316L.

D. Bars and Shapes: ASTM A276-13a, Type 316L.

E. Stainless Steel Cable and Cable Fittings for Stainless Steel Decorative Railings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AGS Stainless Inc.
    b. Atlantis Rail Systems
    c. Greco; CSW Industrials Inc.
    d. HDI Railings
    e. Or Approved Equal

2. Cable: 1-by-19 wire cable made from wire complying with ASTM A492, Type 316, mill finish, unjacketed.
3. Cable Diameter: 1/4 inch.
4. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.

2.4 FASTENERS

A. Fastener Materials:

1. Stainless Steel Railing Components: Type 316 stainless steel fasteners.
2. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Post-Installed Anchors: Concrete expansion anchors not allowed without prior written approval from NPS. Fastener systems with working capacity greater than or equal to the

design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 316 stainless steel bolts, ASTM F593 and nuts & washers, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: 316 stainless steel, center of handrail 2-1/2 inches from wall.

1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
3. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.
4. Provide formed-steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

B. Rubber Grommets at cable penetrations: Provide grommets designed for cable railings, color – black.

1. Cables are 1/4" diameter. Confirm grommets are sized properly for a snug fit, excluding moisture from the interior of the posts.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Prepare railings in the shop to to eliminate field welding, splicing, drilling, and minimize field assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

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

E. Fabricate connections that will be exposed to weather in a manner to exclude water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

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

G. Connections: Fabricate railings with mechanical connections unless otherwise indicated.

H. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.

1. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
2. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

I. Form changes in direction as follows:

1. As detailed.

J. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

K. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.

1. At handrail brackets fastened to gypsum board partitions, ensure bracket attaches directly to studs to prevent bracket or fitting rotation and crushing of substrate.

M. Stainless Steel Cable Guard Infill:

1. Minimize amount of turnbuckle take-up used for dimensional adjustment, so maximum amount is available for tensioning cable.
2. Tag cable assemblies and fittings to identify installation locations and orientations for coordinated installation.

2.7 GENERAL FINISH REQUIREMENTS

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

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Stainless Steel Tubing Finishes:

1. 180-Grit Polished Finish: Uniform, directionally textured finish.

C. Stainless Steel Sheet and Plate Finishes:

1. Directional Satin Finish: ASTM A480/A480M, No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating

metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, attached to post with setscrews.

D. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

E. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.
2. For copper-alloy railings, attach posts as indicated, using fittings designed and engineered for this purpose.
3. For stainless steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
4. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends to steel structure with flanges bolted to metal surfaces and connected to railing ends, using nonwelded connections.

B. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete anchorage, use cast in place anchor assemblies, no drilled-in expansion shields and hanger or lag bolts unless approved by NPS .
2. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made by Contractor from construction budget.

B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings in accordance with ASTM E894 and ASTM E935 for compliance with performance requirements.

C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Contracting Officer and comply with specified requirements.

D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.9 INSPECTION

A. Contractor will commence accessibility inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

END OF SECTION 05 73 00

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Dimension lumber framing.
5. Miscellaneous lumber.
6. Plywood backing panels.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.
6. AWPA: American Wood Protection Association

1.3 ACTION SUBMITTALS

Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

NOTE: All Lumber to be FSC certified

A.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

NOTE: All Lumber to be FSC certified

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. All wood products designated as “FSC certified” in this specification shall be certified according to the rules of the Forest Stewardship Council (www.fscus.org).

B. For all wood products designated in this specification as “FSC certified,” provide evidence of compliance with FSC standards as follows:

1. Demonstrate that products are FSC certified by providing vendor invoices. Invoices will contain the vendor’s Chain-of-Custody (COC) number and identify each FSC certified product on a line-item basis. A “vendor” is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.

2. Wood products without submittal of acceptable documentation will be rejected.

C. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Dress lumber, S4S, unless otherwise indicated.

D. Maximum Moisture Content:

1. Boards: 19 percent.
2. Dimension Lumber: 19 percent.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use categories as follows:

1. UC2: Interior construction not in contact with ground but may be subject to moisture. Include the following items:

   a. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
   b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   c. Wood floor plates that are installed over concrete slabs-on-grade.
   d. Wood millwork.
   e. Wood flooring.

2. UC4B: Critical structural sawn products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, severe environments, and extreme decay potential. Include the following items:

   a. Wood foundation piling
   b. Exterior dining area and boardwalk framing
   c. Exterior wood retaining walls
   d. All other exterior wood framing

3. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
4. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
5. After treatment, redry lumber to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 14 percent. Do not

use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.
6. Exterior wood.

2.3 FIRE-RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment is not to promote corrosion of metal fasteners.
2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings.

2.4 DIMENSION LUMBER FRAMING

NOTE: All Lumber to be FSC certified

A. Non-Load and Load Bearing Wood Walls: Stud grade.

1. Application: Exterior and interior walls
2. Species: Douglas fir-larch

B. Joists, Rafters, and Other Framing by Grade: No. 1 grade.

1. Species: Douglas fir-larch

C. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade:

a. As indicated above for load-bearing construction of same type.
b. Douglas fir-larch; No. 1 grade;

2.5 MISCELLANEOUS LUMBER

NOTE: All Lumber to be FSC certified

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.
8. Concealed boards.

B. Dimension Lumber Items: No.1

1. Douglas Fir-Larch

C. Roofing Nailers: No. 1-grade lumber or better; kiln-dried Douglas fir, or wood having similar decay-resistant properties.

D. For blocking not used for attachment of other construction, No. 1-grade lumber or better; kiln-dried Douglas fir

E. For furring strips for installing plywood or hardboard paneling, No. 1-grade lumber or better; kiln-dried Douglas fir, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 WOOD STRUCTURAL PANEL SHEATHING

A. Plywood, DOC PS 1, APA Rated in thickness indicated.

1. All sheathing may be subject to repeated wetting and redrying or long-term exposure to weather or similar conditions: Exterior Plywood with exterior glue, grade C-C, 5-ply minimum per APA PS 1.
2. Where “Structural 1” is required per the plans, use grade Structural 1 sheathing 5ply minimum per APA PS 1 or 2.
3. Floor plywood shall be APA Rated 7 ply “Sturdifloor” 3/4 inch T&G.

2.7 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide marine grade 316 Stainless Steel fasteners.
2. No Pneumatic fasteners will be allowed on framing, exterior siding, exterior trim or any other related work without prior consent to written request by the contractor to the NPS COR/PM.
3. Predrill material as required to prevent splitting of lumber. NPS reserves the right to reject split material, replacement of which is not necessarily limited to a specific location and may require additional removal of material as solely determined by the NPS.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets:

1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
2. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard

widths to suit width of sill members indicated.

3. Self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable compound, bonded to a high-density polyethylene film, 316 Stainless Steel foil to produce an overall thickness of not less than 0.025 inch.

C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION

NOTE: Pneumatic fastening/attachment of Framing, Blocking or any other types of lumber prohibited without providing demonstration of suitability mock-up and approval of written request by the contractor to the NPS COR/PM.

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated herein.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

F. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

G. Do not splice structural members between supports unless otherwise indicated.

H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

J. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

K. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

L. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

N. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

O. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between

members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring

C. Furring to Receive Gypsum Board or Plaster Lath: Install 1-by-2-inch nominal- size furring vertically

3.4 INSTALLATION OF WALL AND PARTITION FRAMING

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated

3.5 INSTALLATION OF FLOOR JOIST FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:

1. Where supported on wood members, by using metal framing anchors.
2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.

C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.

E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.

H. Provide solid blocking between joists under jamb studs for openings.

I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and

similar heavy finishes or fixtures.

J. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.

1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- size lumber, double-crossed and nailed at both ends to joists.
2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.7 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 06 15 33 - WOOD PATIO DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood decking on first floor and third floor.
2. Wood railings and railing posts
3. Wood posts, girders, and joists.
4. Stair treads and stringers.
5. Pedestals for third floor deck.

B. Related Requirements:

1. Section 05 50 00 “Metal Fabrications” for 316 stainless steel angle at third floor deck.
2. Section 06 10 00 "Rough Carpentry" for pressure-treated Douglas Fir structure.
3. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing used with patio decking.

1.2 DEFINITIONS

A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Timber: Lumber of 5 inches nominal or greater in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. RIS: Redwood Inspection Service.
2. FSC: Forest Stewardship Council
3. AWPA: American Wood Protection Association

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

B. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

C. Include data for wood-preservative treatment from chemical-treatment manufacturer and

certification by treating plant that treated wood. Indicate type of preservative and penetration rating. Include chemical-treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
2. For all fasteners: include each type of fastener, location to be used, dimensional data of fastener and material to be fastened.

D. Samples: For each exposed product and for each color, includes finishes per Sections 09 91 13 & 09 93 00 "Staining and Transparent Finishing" including surface texture specified. Shall be not less than 24 inches long, showing the range of variation to be expected in appearance, including surface texture & stained as per 09 91 13.

1. 2x6 Patio Decking
2. 3rd Floor 5/4 x 6 Decking
3. Patio Guardrail Cap
4. Stair Treads & Stringers

E. Sustainable Design Submittals:

1. All wood products designated as "FSC certified" in this specification shall be certified according to the rules of the Forest Stewardship Council (www.fscus.org).
2. Environmental Product Declaration: For each product.
3. Third-Party Certifications: For each product.
4. Third-Party Certified Life Cycle Assessment: For each product.

F. Samples - For wood decking, rail posts & horizontal railing not less than 24 inches long, showing the range of variation to be expected in appearance of decking, including surface texture.

G. Shop Drawings – Provide shop drawings for third floor wood deck layout for review for compliance with the contract documents.

H. Mockups

1. Provide preconstruction meeting for each required mockup with NPS COR prior to installing to review objectives, material samples and locations.

2. Mockups shall be reviewed and approved by COR prior to commencement of the of work item. Mockups shall be reviewed for compliance with performance and quality expectations and shall set the quality standard for the remainder of the work.

3. Provide mockup for the third floor deck. One panel minimum, including wood decking and angle frame, with pedestals. Coordinate w/Sec. 07 62 00 Sheet Metal Flashings, 07 27 26 Fluid Applied Membrane, 07 54 19 PVC Roofing, 06 20 13 Exterior Carpentry.

4. Provide mockup for Patio Guardrail, one panel complete w/ all hardware, cap,

siding and trim.

5. Mockups may be created as part of the work in progress with prior approval from NPS Project Manager/COR but must pass the review process in order to remain. Mockups that are rejected must be removed from the project without damage to surrounding materials.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

C. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood products.
2. Decking fasteners.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

1.6 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Certified Wood: All wood products designated as “FSC certified” in this specification shall be certified according to the rules of the Forest Stewardship Council (www.fscus.org).

Includes:

1. Decking
2. Posts, Girders & Joists
3. Stair Treads & Stringers
4. Guardrail Assembly
5. Exterior tongue and groove siding

B. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.

1. Factory mark each item with grade stamp of grading agency.
2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece, or, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Provide dressed lumber, S4S, unless otherwise indicated.

C. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane. COR has authority to reject and require contractor replace at no cost to the Govt., non-conforming, non-compliant or objectional materials that are not reasonable interpretations of the approved sample or this quality description.

D. Lumber for Decking, Railing Posts, Railings, Caps, Stair Stringers and Treads, Guard Rails, Exterior Trims and Siding, Shall Be FSC Certified Redwood.

E. Maximum Moisture Content:

1. Boards: 19 percent.
2. Dimension Lumber: 19 percent.
3. Timber. 19 percent.

2.2 WOOD DECKING

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane. NPS Project Manager/COR has authority to reject and require contractor replace at no cost to the Govt., non-conforming, non-compliant or objectional materials that are not reasonable interpretations of the approved samples or of this

quality description.

B. Dimension Lumber Patio & Ramp Decking:

1. Redwood – S4S 2X6, B Grade, FSC, RIS all heart. kiln dried.

C. 3rd Floor Decking: 1-1/4-inch actual thickness of the following species and grades:

1. Redwood, S4S 5/4 x 6, RIS, Quarter Sawn, Clear All Heart, Vertical Grain, FSC, Kiln Dried.

2.3 WOOD RAILINGS AND RAILING POSTS

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane. NPS Project Manager/COR has authority at no cost to the Govt., to reject non-conforming, non-compliant or objectional materials that are not reasonable interpretations of the approved sample or this quality description.

B. Dimension Lumber Railing Members:

1. FSC Redwood, S4S, RIS Clear All Heart, Kiln Dried.

C. Railing Boards:

1. FSC Redwood, S4S, RIS Clear All Heart, Kiln Dried.

2.4 POSTS, GIRDERS, AND JOISTS

A. Dimension Lumber Posts, Girders, and Joists:

1. FSC Pressure Treated Douglas Fir, No. 1 & Btr.
2. AWPA UC4B, .60 Retention

2.5 STAIR TREADS AND STRINGERS

A. Dimensional Lumber Treads/Stringers.

1. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane. COR has authority to reject and require contractor replace at no cost to the Govt., non-conforming, non-compliant or objectional materials that are not reasonable interpretations of the approved sample or of this quality description.

2. Redwood, All Heart, FSC, B Grade
3. Treads: 4x12
4. Stringers: 3x12

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

B. Predrill material as required to prevent splitting of lumber. NPS reserves the right to reject split material, replacement of which is not necessarily limited to a specific location and may require additional removal & replacement of material as solely determined by the NPS.

1. Use Marine Grade 316 stainless steel unless otherwise indicated.

C. Nails: Not permitted

D. Power and Pneumatic Driven Fasteners: Not permitted.

E. Wood Screws and Lag Screws: Use Marine Grade 316 stainless steel unless otherwise indicated.

F. Stainless Steel Bolts: Use Marine Grade 316 stainless steel unless otherwise indicated.

G. Post-installed Anchors: Only permitted with prior written approval from NPS. Stainless steel, torque-controlled expansion anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing in accordance with ASTM E488 conducted by a qualified independent testing and inspecting agency.

1. Stainless steel bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.7 PEDESTALS

A. Only provided at the third floor wood deck to allow free drainage to scuppers.

B. Basis of Design: Bison Innovative Products, Bison LOW Pedestal System

C. Salient Characteristics:

1. Low Height Pedestal System; all parts by a single manufacturer in an integrated system including pedestals, shims, fasteners, and levelers.
2. Smallest height pedestal: 1/8 inch high
3. Capacity: 1250 lbs. per pedestal
4. Center Loaded
5. Material: High Density Copolymer Polypropylene
6. 20% Post Industrial Recycled Material

D. Pedestal heights: Range of 1/8” to 3/4” stackable pedestals. It is the responsibility of the contractor to evaluate what lengths are needed to provide level walking surface with the

sloped roofing installation.

E. Contractor to coordinate installation of pedestals with 316 stainless steel angle at decking perimeter. See details.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Stain or seal wood, including both faces and all edges prior to installation. Cut to required lengths and stain ends during installation. Comply with requirements in Sections 09 91 13 & 09 93 00 "Staining and Transparent Finishing."

3.3 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.

C. Install wood decking with crown up (bark side down).

D. Secure decking to framing with stainless steel deck splines, deck clips, deck tracks, or screws.

E. Predrill at ends and in any vulnerable locations as required to eliminate splitting. Split material subject to replacement by contractor as per NPS Project Manager/COR discretion, authority and direction at no cost to the Govt.

F. NOTE: split material removal and replacement not necessarily limited to damaged individual unit, extents shall be determined by NPS Project Manager/COR.

G. Install metal framing anchors to comply with manufacturer's written instructions.

H. Do not splice structural members between supports unless otherwise indicated.

I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

J. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

K. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. "Fastening Schedule" in ICC's International Building Code.

L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

3.4 INSTALLATION OF ELEVATED DECK JOIST FRAMING

A. General: Install joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists where framed into wood supporting members by using wood ledgers as indicated or, if not indicated, by using metal joist hangers. Do not notch joists.

B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

C. Lap members framing from opposite sides of beams or girders not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

D. Provide solid blocking of 2-inch nominal thickness by depth of joist at intervals of 96 inches o.c. between joists.

3.5 INSTALLATION OF RAILINGS

A. Balusters: Fit to railings, glue, and screw in place. Countersink fastener heads, fill flush, and sand filler.

B. Newel Posts: Secure to stringers and risers with through bolts.

C. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts and glue.

3.6 INSTALLATION OF DECKING AT THIRD FLOOR DECK

A. Per drawings, install decking in panels to allow removal of sections for maintenance of roofing.

B. Panels shall be formed by wood decking fastened to 316 stainless steel angle frames, fastened with stainless steel countersunk screws from the underside of the decking.

C. Panels shall be set on pedestals at corners and along edge to support panel as a level

walking surface. Contractor responsible for providing enough pedestal sections to achieve level surface.

D. Deck shall be at same finish floor elevation as third floor interior; see details.

E. Deck panels shall not be supported on the roofing without a pedestal between them.

3.7 INSPECTION

A. Contractor will commence accessibility inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

1. This primarily relates to compliance with floor, deck and ramp surface changes, but all aspects of ABAAS compliance shall be reviewed.

END OF SECTION 06 15 33

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SECTION 06 20 13 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lumber siding.

a. Redwood Tongue and Groove Siding and Soffit.

2. Rainscreen vents and battens.
3. Boardwalk ramp
4. Patio guardrail

B. Related Requirements:

1. Section 09 29 00 "Gypsum Board" for soffit vents.
2. Section 06 10 00 "Rough Carpentry" for pressure-treated Douglas Fir structure.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for sheet metal flashing used with patio decking.
4. Section 08 51 13 “Aluminum Windows”

1.2 PRE-INSTALLATION SITE MEETING

A. Contractor to arrange for, document and facilitate meeting with NPS, Contractor, Window installer, Siding installer, Sheetmetal & Flashing installer, Roofing installer & Sealant Manufacturer’s Representative. For details see 08 51 13 (1.3 &1.4)

1.3 DEFINITIONS

A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Timber: Lumber of 5 inches nominal or greater in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. RIS: Redwood Inspection Service.
2. FSC: Forest Stewardship Council
3. AWPA: American Wood Protection Association

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
3. For all fasteners: Include each type of fastener, location to be used, dimensional data of fastener and material to be fastened.

B. Sustainable Design Submittals:

1. FSC Compliance and Chain of Custody Certificate
2. Environmental Product Declaration: For each product.
3. Third-Party Certifications: For each product.
4. Third-Party Certified Life Cycle Assessment: For each product.

C. Samples: For each exposed product and for each color, includes finishes per Sections 09 91 13 & 09 93 00 "Staining and Transparent Finishing" including surface texture specified. Shall be not less than 24 inches long, showing the range of variation to be expected in appearance, including surface texture & stained as per 09 91 13.

1. T & G Siding
2. Full 2 inch dimension 2x Exterior Trim
3. Rain Screen Components & Fasteners
4. Accessible ramp Framing, Posts, Rails & Decking

D. Shop Drawings

1. For Boardwalk ramp, wood and steel rail: include plans, elevations, sections at concrete, and attachment details.
2. For Patio guardrail: include plans, elevations, sections, and attachment details.

E. Mockups

Provide preconstruction meeting for each required mockup with NPS Project Manager/COR 7 calendar days prior to installing in-place work to review objectives, material samples and locations.

1. Mockups shall be reviewed and approved by NPS Project Manager/COR prior to commencement of the of in-place work item. Mockups shall be reviewed for compliance with performance and quality expectations and shall set the quality standard for the remainder of the work.

2. Provide mockups of the following:

   a. Siding installation over representative framing substrate with all fasteners, rainscreen components, waterproof membrane layers, window, door, and corner wood trims, Flashings, Sealants
   b. Boardwalk ramp & Guardrail assembly
   c. Coordinate w/Sec. 07 62 00 Sheet Metal Flashings, Sec. 08 51 13 Aluminum Windows
   d.

3. Mockups may be created as part of the work in progress with prior approval from NPS Project Manager/COR but must pass the review process in order to remain. Mockups that are rejected must be removed from the project without damage to surrounding materials as approved by the NPS Project Manager.

1.5 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. FSC Certification

B. Sample Warranties: For manufacturer's warranties.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited

to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

1. All exterior wood products designated as “FSC certified” in this specification shall be certified according to the rules of the Forest Stewardship Council (www.fscus.org).

2. Exterior Trim, Fascia, Decking,
3. Ramp Framing, Rails, Retaining Walls
4. Exterior tongue and groove siding and soffits.
5. Guard Rails, Ramps & Decking

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

C. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane. COR has authority to reject and require contractor replace at no cost to the Govt., non-conforming, non-compliant or objectional materials that are not reasonable interpretations of the approved sample or of this quality description.

D. Softwood Plywood: DOC PS 1.

E. Hardboard: ANSI A135.4.

F. Siding and exterior trim shall be prefinished or back-primed prior to installation Cut to required lengths and stain ends during installation. Comply with requirements in Sections 09 91 13 & 09 93 00 "Staining and Transparent Finishing."

G. All horizontal joints to be cut with 22.5 degree bevel to shed water and treated with brush applied clear sealant visually compatible with surface finish.

2.2 EXTERIOR TRIM

A. Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade:

   a. Redwood; S4S, FSC Quarter Sawn vertical grain, RIS Clear All Heart.

2. Maximum Moisture Content: 19 percent.
3. Finger Jointing: Not allowed.
4. Face Surface: Surfaced (smooth).
5. Trim profiles as shown on drawings.
6. Exterior Corners, Window and Door trim are true 2 inch x 4 inch trim, not 1-½ nominal.
7. 3/4" minimum distance between face of T&G siding and face of trim required.

2.3 LUMBER SIDING

A. Provide kiln-dried lumber siding complying with DOC PS 20.

B. Species and Grade:

1. Redwood; FSC, RIS Quarter Sawn vertical grain, Clear All Heart.

C. Pattern:

1. S4S, square-edge, smooth-faced tongue and groove, actual face width (coverage)of 3-1/8” and thickness of ¾ inches LUMBER SOFFITS

D. Provide kiln-dried lumber siding complying with DOC PS 20.

E. Species and Grade:

1. Redwood; FSC, RIS, Quarter Sawn vertical grain, Clear All Heart.

F. Pattern:

1. S4S, V-edge, smooth-faced tongue and groove, actual face width (coverage) and thickness of 3-1/8 by 3/4 inch.

2.4 EXTERIOR TRIM

2.5 Species and Grade: Redwood; FSC, RIS, Quarter Sawn vertical grain, Clear All Heart.
2.6 Note exterior trim is full dimension 2 inches in thickness to allow for finished face of trim to extend ¾’s of an inch proud of the face of the exterior siding.
2.7 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: If manufacturer provides manufacturer recommended fastener size and pattern, with approval of the NPS Project Manager/COR. manufacturer’s guidance may take precedence over guidance described as basis of design below.

1. For all applications, provide 316 stainless steel fasteners.
2. Nails to penetrate not less than 1-1/2 inches into wood substrate.

3. Basis of Design for Siding:

   a. Fastener sizing: 10d x 3 inch ring shank 11 Ga. 316 stainless steel finishing nails.
   b. Fastener pattern: blind nailed, 16 inches on center into solid blocking.

   c. Unattached siding shall not exceed 4" in any direction without being fastened into solid backing.
   d. Predrill at ends and in any vulnerable locations as required to eliminate splitting. Split material subject to replacement by contractor as per NPS Project Manager/COR discretion, authority and direction at no cost to the Govt.
   e. NOTE: split siding removal and replacement not necessarily limited to damaged individual unit, extents shall be determined by NPS Project Manager/COR.

4. Basis of Design for Exterior Trim:
5. Redwood; FSC, RIS Quarter Sawn vertical grain, Clear All Heart.

   a. Note: exterior trim is full dimension 2 inches in thickness to allow for finished face of trim to extend ¾'s of an inch proud of the face of the exterior siding.
   b. 2 x Fastener sizing: 16d x 3-1/2 inch ring shank .162 dia. 316 stainless steel headed nails
   c. Note: Unattached exterior trim shall not exceed 4" in any direction without being fastened into solid backing.
   d. 1x Fastener Sizing: 8d x 2-1/2 inch ring shank .131 dia. 316 stainless steel headed nails.
   e. Fastener pattern: face nailed, 16 inches on center/

   f. Predrill at ends and in any vulnerable locations as required to eliminate splitting. Split material subject to replacement by contractor as per NPS Project Manager/COR discretion, authority and direction at no cost to the Govt.
   g. NOTE: split siding removal and replacement not necessarily limited to damaged individual unit, extents shall be determined by NPS Project Manager/COR.

B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

C. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

D. Rainscreen Battens:

1. Basis of Design Manufacturer: COR-A-VENT, or approved equal.
2. At head and foot of wall: COR-A-VENT SV-3, or approved equal.
3. Horizontal battens: COR-A-VENT Sturdi-Batten, or approved equal; spaced per manufacturer's recommendation.
4. Salient Characteristics:

a. Multi-celled venting system designed to be used in rainscreen systems behind siding. All components of system to be from one manufacturer.
b. Heat-resistant: made from extruded polypropylene plastic.
c. Impact-resistant: capable of being screwed, stapled, or power-nailed in place w/316 Stainless Steel fasteners.
d. Crush-resistant: does not compress like “drainage mat” products
e. System has top of wall and bottom of wall products separate from the field battens.
f. Approximately 7/16” thick. More or less than this requires an RFI to evaluate the impact to the wall detailing.
g. Manufacturer must provide system recommended installation methods and details for use behind a vertical siding application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut exterior finish carpentry to fit adjoining work.
3. Refinish and seal cuts as recommended by manufacturer.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 72 inches long, except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

B. Fit exterior joints to exclude water.

1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

3.5 INSTALLATION OF SIDING

A. Install siding to comply with manufacturer's written instructions for blind nailing.

B. Install siding over rainscreen vents and battens, per drawings.

C. Vertical Lumber Siding

1. Plan starter strip planning for partial boards to occur at inside corners. If no inside corners on a wall, plan layout so that partial boards are greater than half a board and pattern is centered on the wall.
2. Install subsequent courses with tongue-and-groove edges tightly fitted together.

    a. Nail at each batten.
    b. Nails must be 316 stainless steel.
    c. Installation must provide a minimum of 1.5” nail penetration into solid wood.

3. Siding shall be blind nailed.

4. Predrill at ends and in any vulnerable locations as required to eliminate splitting. Split material subject to replacement by contractor as per NPS Project Manager/COR discretion, authority and direction at no cost to the Govt.

5. Split material removal and replacement not necessarily limited to damaged individual unit, extents shall be determined by NPS Project Manager/COR.

6. Leave 1/8 inch gap at trim and corners unless otherwise recommended by manufacturer.

D. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.

E. Finish: Stain or seal wood, including both faces and all edges prior to installation. Cut to required lengths and stain ends during installation. Comply with requirements in Sections 09 91 13 & 09 93 00 "Staining and Transparent Finishing."

3.6 CLEANING

A. Clean exterior finish carpentry on exposed and semi-exposed surfaces.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 13

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SECTION 06 20 23 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior Wood Trim

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.
2. Section 06 40 00 " Architectural Woodwork" for cabinetry and foot rail.
3. Section 09 93 00 "Staining and Transparent Finishing" for staining of interior finish carpentry.

1.2 DEFINITIONS

A. MDO: Plywood with a medium-density overlay on the face.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Interior trim: Dimensions, Species & grade of materials.
2. All wood trim materials, jambs, casings, base, treads& skirt boards at stairs, crowns, mouldings and similar items.
3. Fasteners: Include each type of fastener, location to be used, dimensional data of fastener and material to be fastened.
4.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

C. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.
2. Third-Party Certifications: For each product.

3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
4. Product Data: For installation adhesives, indicating VOC content.
5. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

D. Samples: For each exposed product and for each color and texture specified.

E. Mockups

1. Provide mockups of the following:
   a. Window trim

2. Mockups shall be one entire window.
3. Mockups shall be reviewed by NPS Project Manager/COR for compliance with quality expectations and shall set the quality standard for the remainder of the work
4. Mockups may be created as part of the work in progress but must pass the review process in order to remain. Mockups that are rejected must be removed from the project without damage to surrounding materials.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
   1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
   2. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

Certified Wood: The following wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.

1. Interior trim.
2. Cabinets.
3. Fire-rated interior door frames.
4. Interior stairs and railings.

B. Composite Wood Products: Products shall be made without urea formaldehyde.

C. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.

D. Softwood Plywood: DOC PS 1. APA rated exterior grade

E. Hardboard: ANSI A135.4.

2.2 INTERIOR TRIM

A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: White Oak; NHLA Clear.
2. Maximum Moisture Content: 13 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Not allowed.
5. Veneered Material: Not allowed.
6. Face Surface: Surfaced (smooth).
7. Matching: Selected for compatible grain and color.
8. Wood boards as specified above for hardwood lumber trim for transparent finish.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Pre-drill as required to prevent splits in material. NPS Project Manager/COR will require replacement of split material at no expense to the government.

Exposed (Clear Sealed or Stained natural wood): Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, Flush set or slightly recessed, 316 Stainless Steel, concealed where possible. .

Painted: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, HD Galvanized, countersunk, filled w/putty, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. Adhesives shall have a VOC content of 30 g/L or less.

C. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 FABRICATION

A. Back out or kerf backs of the following members, miter all ends exposed in finished work:

1. Interior standing and running trim, except shoe and crown molds.
2. Door Jambs
3. Wood-board paneling.

B. All wood trim materials, jambs, casings, base, skirt boards at stairs, crowns and similar items shall be back primed or sealed prior to installation.

C. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 INSTALLATION OF INTERIOR TRIM

A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.

1. Do not use pieces less than 24 inches long, except where necessary.
2. Stagger joints in adjacent and related standing and running trim.
3. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.
5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
7. Install trim after gypsum-board joint finishing operations are completed.
8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
9. Fasten to prevent movement or warping.
10. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements.

1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean interior finish carpentry on exposed and semi-exposed surfaces.

B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 23

SECTION 06 40 00 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Custom Built Marine Plywood Cabinets.
      a. At Break Area 201
      b. At ABAAS Shower 111, Countertop Substrate
      c. Bid Option A: At Shower Rooms 110, 112, 133
   2. Wood Foot Rail with Wrapped Climbing Rope Finish.

B. Related Sections:
   1. Section 05 50 00: “Metal Fabrications.”
   2. Section 06 20 23: “Interior Finish Carpentry” for interior trim.
   3. Section 09 93 00: “Staining and Transparent Finishes.”
   4. Section 12 36 61.16: “Solid Surface Countertops”

1.2 REFERENCES

A. Architectural Woodwork Institute (AWI) Quality Standards, current edition.

B. ANSI/BHMA A156.1 – Cabinet hardware highest rated for marine environment
ANSI/BHMA A156.18- Materials & Finishes highest rated for marine environment

1.3 SUBMITTALS

A. Product Data:
   1. Submit following for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
      a. Local/Regional Materials:
         1) Indicate location of manufacturing facility; indicate distance between manufacturing facility and project site.
         2) Indicate location of extraction, harvesting, and recovery and project site.

      b. VOC Data:
         1) Adhesives:
            a) Submit manufacturer’s product data for adhesives.
            b) Indicate VOC limits of product.
            c) Submit MSDS highlighting VOC limits.
            d) Submit Green Seal Certification to GS-36 and description of basis for certification.

B. Submit environmental data in accordance with Table 1 of ASTM E 2129 for products provided under this Section.

C. Samples:

1. Submit Cabinet Door sample including epoxy finish for NPS approval prior to proceeding with mock-up.

2. Exposed and Semi-Exposed Hardware: Includes drawer slides, pulls, hinges, shelf pins & foot rail support brackets. Submit one unit for each type and finish.

D. Shop Drawings:
   1. Submit to NPS Project Manager/COR for review on all Work in this Section, includes cabinetry, countertops & shelving
   2. Show in large scale construction of various parts of work; methods of joinery; profiles of moldings; provisions for assembly and installation; methods of reinforcement, anchorage, and support, and blocking requirements for support (within walls).
   3. Scale and detail as per AWI Appendix.

E. Mockups:
   1. Representative unit of custom cabinetry must be reviewed by NPS Project Manager/COR prior to finish application & installation to allow for review of craftsmanship and overall conformance with the specification.
      a. Mockup to include minimum one cabinet unit, sides, back, front and cabinet door(s) with drawer(s) including the actual representative cabinet hardware to be provided for the entire scope of the project .
      b. Review of a mockup in a shop by the NPS (within a reasonable distance as determined by the NPS Project Manager/COR) is allowable with prior permission from the NPS Project Manager/COR.
   2. Representative unit of rope wrapped foot rail must be reviewed by NPS Project Manager/COR prior to full installation of rope.
      a. Mock up to include starting and finishing sections to show how rope finish starts and terminates.
      b. Mockup shall be with the actual rope product to be provided.
   3.

1.4 QUALITY ASSURANCE

A. Quality Standard:
   1. Work in this Section shall comply with or exceed specified Grade(s) of Work and Sections(s) of current edition of Architectural Woodwork Institute Quality Standards and comply with specific standards included in this specification which are to reflect the maximum degree of protection against the corrosive effects of the marine environment.
   2. Perform work in accordance with AWI Premium Grade quality.
   3. Woodwork manufacturers shall be certified by AWI Quality Certification Program as competent to perform Work specified.
   4. Certification shall be evidenced through application of AWI Quality Certification labels and/or issuance of an AWI letter of certification for project.

B. Qualifications:
   1. Contractors and their personnel engaged in Work shall be able to demonstrate successful experience with work of comparable extent, complexity, and quality to that shown and specified.
   2. As documentation, manufacturer shall submit neutral Prequalification Form found in Appendix to AWI Quality Standards, current edition.
   3. Manufacturer shall be a member in good standing of Architectural Woodwork Institute.

C. Mockup:
   1. Prior to fabricating or installing interior or exterior architectural woodwork, construct mockup to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
   2. Provide units with specified lamination and with hardware installed.
   3. Mockup may remain as part of Work by prior arrangement and approval of NPS project manager/COR. Mockup must show joinery and panel detail.

D. Intent and Control Sample: Work in this Section is intended to meet "Test of Time," in an environment exposed to the extreme adverse impact from the marine climate, to be used for many decades, excepting ordinary wear of finish, vandalism or willful destruction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver or install woodwork until building is enclosed; wet work is complete; HVAC system is operating and maintaining temperature; relative humidity at occupancy levels during remainder of construction period; or until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas.

B. Protect units from moisture damage according to AWI Quality Standards, Section 1700, Installation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify that field measurements are as indicated on shop drawings.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Wood:
   1. Wood for Custom Cabinetry:
      a. Box, Base & Partition construction:
         Marine Grade Birch plywood, 3/4" min.
      b. Face Frames:
         Paint Grade solid Birch, 3/4” typ.
      c. Shelves:
         Marine Grade Birch plywood, 3/4" min. w/1/2” x 3/4” Paint Grade Birch edge-bands typical on front facing edges
      d. Profile: Flat, w/overlay doors and drawers
      e. Doors : Painted ¾" Marine Grade Baltic Birch plywood, 13 laminations, G2S, w/3/4” x ½" edge banding all edges
      f. Drawer Boxes:
         Front Faces, Painted, Cabinet Grade, clear, ¾" solid Birch, w/ 3” wire pull handles.
         Boxes, 2 sides 5/8”, front & back 1/2”, marine grade Baltic Birch, w/1/4” bottom
         Drawer Slides, full extension, 316 Stainless Steel
      g. Surface Texture: Sanded.
      h. Finish: Shop Painted Epoxy.

2. Wood for Foot Rail:
    a. Material: Clear Douglas Fir, painted.
    b. Size: 3” dia., length as shown on drawings.
3. Moisture Content: Comply with requirements of referenced quality standard for moisture content of Work in this Section in relation to relative humidity conditions existing during time of fabrication and in installation areas; 10 percent for interior work and 19 percent for exterior work (AWI 100-S-11)
4. All wood shall be procured from a sustainable farmed source.

B. Sheet:
1. Marine Plywood:
    a. Manufacturers:
        i. Canusa Wood
        ii. Roseburg Forest Products
        iii. Or Approved Equal
    b. AWI Grade specified, hardwood, made with high waterproof resin adhesive, sanded faces.
    c. Face Grade: A/B
    d. Back Grade: 1

C. Hardware:
1. Material: 316 Stainless Steel
2. Finish: Matte.
3. Concealed and Adjustable Hardware for Mounting of Removable Shelves
4. Drawer Hardware: Rails, self closing; wire pull, 3” min.
5. Cabinet Hinges: Full overlay, soft close, basis of design Blum Clip top 110 degree concealed style fully adjustable hinge or equivalent.

D. Accessory Materials
1. Climbing Rope (for wrapping food rest) – 7/16” (13 mm), static, dry core and dry sheath. Color as selected by NPS Project Manager/COR from manufacturer’s standard options.

2.2 FABRICATION

A. Interior Woodwork:
1. Quality Standard: AWI Quality Standards, Premium Grade.

B. Shop Fabrication:
1. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible.
2. Disassemble components only as necessary for shipment and installation.
3. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut Openings:
1. Shop-cut openings, to maximum extent possible, to receive hardware, and similar items.
3. Smooth edges of removable shelving units and seal edges with a water-resistant coating.

D. Backcut or Groove, and Kerfed Backs:
1. Backcut or groove backs of flat trim members and kerf backs of other wide, flat members,

except for members with ends exposed in finished woodwork.

2. Return exposed ends.

2.3 FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. Finish work in factory in accordance with AWI Quality Standards – Section 1500 Systems.

D. Finish work to meet AWI Premium Quality Standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurements: Make all required measurements in field to ensure proper and adequate fit of architectural woodwork items.

B. Inspection:
1. Prior to all work of this Section, carefully inspect installed work of all other trades and verify that all such work is complete to point where fabrication and installation of work of this Section may properly commence.
2. Verify that architectural woodwork may be fabricated and installed in complete accordance with original design, accepted Shop Drawings, and reference.

C. Discrepancies:
1. In event of discrepancy, immediately notify NPS Project Manager/COR.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

D. Verify adequacy of backing and support framing.

E. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing (this is critical for out of state manufacturers).

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

3.3 INSTALLATION AND WORKMANSHIP

A. General:
1. Install work in accordance with AWI Premium Quality Standard.
2. Set and secure materials and components in place, plumb and level.
3. Scribe work abutting other components, with maximum gaps of 1/32 inch; do not use additional overlay trim to conceal larger gaps.
4. Countersink anchorage devices at exposed locations; conceal with solid wood plugs of species to match surrounding wood; finish slush with surrounding surfaces.
5. Back prime all concealed surfaces.
6. Back prime all wall panels with minimum two heavy coats of finish to balance face.
7. Furring, blocking, shims, and hanging strips:
   a. Hardwood lumber, kiln dried to 15 percent moisture content.
   b. Marine plywood.

8. Screws:
   a. Select material, type, size, and finish required for each use.
   b. Comply with ASME B18.6.1 for applicable requirements.

9. Nails:
   a. Select material, type, size, and finish required for each use.
   b. Comply with FS FF-N-105 for applicable requirements.

10. Anchors:
    a. Select material, type, size, and finish required for each substrate for secure anchorage.
    b. Provide hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.

B. Jointing:
1. Make all joints to conceal shrinkage, miter all exterior corners; cope all interior corners, scarf all end-to-end joints.
2. Cope trim at returns and internal angles.
3. Miter trim at splices in long runs and external corners.
4. Scribe accurately to adjoining Work.

C. Fastening:
1. Install all items straight, true, level, plum, and firmly anchored in place; where blocking or baking is required, coordinate as necessary with other trades to ensure placement of all required backing and blocking in a timely manner.
2. Nail trim with finished nails of proper dimension to hold the member firmly in place without splitting wood.
3. Screw, do not drive all wood screws; however, screws may be started by driving and then screwed home.
4. Use concealed fasteners where possible; face nailing shall be used as absolute minimum.

D. Mechanical and Electrical Cutouts:
1. Provide cutouts for mechanical and electrical items as required.
2. Make cutouts neatly and in accordance with NEMA Standards.
3. All cutouts are to be fully concealed by standard size cover plates where provided.
4. Return all exposed ends.

5. Running joints to be scarf or diagonal joint.

E. Shelving:
   1. Support with end and intermediate supports, arranged to prevent buckling and sagging.

F. Finishing Work:
   1. Complete finishing work specified in this Section to extent not completed at shop or before installation of woodwork.
   2. Fill nail holes with matching filler where exposed.
   3. Apply specified finish coats, including stains and paste fillers, if any, to exposed surfaces where only sealer/prime coats were applied in shop.

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.

B. Adjust joinery for uniform appearance.

C. Clean woodwork on exposed and semi-exposed surfaces.

D. Touch up shop applied finish to restore damaged or soiled areas.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and installer that will ensure woodwork is without damage or deterioration at time of Substantial Completion.

3.6 CLEANING

A. Clean work under provisions of Section 017419, “Cleaning, Waste Management and Disposal.”

B. Clean shelves, hardware, fittings, and fixtures.

3.7 FINAL INSPECTION AND CLOSE OUT

A. Contractor will commence accessibility inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

B. Completely check each installed item and adjust for proper operation prior to final inspection and acceptance by NPS Project Manager/COR.

C. Provide NPS Project Manager/COR with care and maintenance instructions manual.

END OF SECTION 064000

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SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing.
2. Damproofing shall only be applied where building is adjacent to hard surfaces, such as concrete sidewalks, concrete aprons.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete substrate and bituminous vapor retarders under slabs-on-grade.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course,and auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. VOC Content: Products are to comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. APOC, Inc; a division of Gardner Industries
2. Brewer Company (The)
3. ChemMasters, Inc
4. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
5. W. R. Meadows, Inc
6. Or Approved Equal

B. Trowel Coats: ASTM D1227, Type II, Class 1.

C. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.

D. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

2.4 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.

D. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.

E. ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.

1. Thickness: Nominal 1/8 inch.
2. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer for protection course type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.

B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.

D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.

1. Apply dampproofing to provide continuous plane of protection.
2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.

1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

3.4 INSTALLATION OF COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Concrete Foundations and Parged Masonry Foundation Walls: Apply one fibered brush or spray coat at not less than 3 gal./100 sq. ft..

B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..

3.5 INSTALLATION OF PROTECTION COURSE

A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.

1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
2. Install protection course on same day of dampproofing installation (while coating is tacky) to ensure adhesion.

3.6 PROTECTION

A. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

B. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.

END OF SECTION 07 11 13

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mineral-wool blanket insulation.

a. At exterior walls
b. Within roof structure

2. Mineral-wool board insulation.

a. Under first floor slab, at slab on grade and at suspended slab
b. Cast in anchors for fastening insulation under first floor slab

3. Closed Cell Spray Foam Insulation

a. In parapet cavity
b. In exterior railing posts
c. At air barrier joints as annotated in the details

4. Vapor Retarder

a. At slab on grade
b. Tape for mechanical seal to cast concrete slab

B. Related Requirements:

1. Section 03 10 00 “Concrete Forming and Accessories” and 03 30 00 “Cast In Place Concrete” for adjacent concrete slab.
2. Section 06 10 00 "Rough Carpentry" for framing.
3. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
4. Section 22 07 19 "Plumbing Piping Insulation" for insulation associated with piping.
5. Section 07 54 19 "Polyvinyl-Chloride (PVC) Roofing" for insulation above roof deck, provided as part of roofing system.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with NPS Project Manager/COR, Manufacturer's Certified Installer, mineral wool board manufacturer's designated field representative, and installers of work that interfaces with or affects mineral wool board.
2. Review methods and procedures related to mineral wool board installation, including manufacturer's written instructions.

3. Review and finalize construction, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine substrate conditions and finishes for compliance with requirements.
5. Review flashings, special mineral wool board details, mineral wool board penetrations, and condition of other construction that affects mineral wool board.
6. Review mineral wool board manufacturer's Project registration and observation process.
7. Review temporary protection requirements for mineral wool board during and after installation.

1.3 ACTION SUBMITTALS

A. Manufacturers Product Data: For each type of specified insulation to be installed, attachment product and accessory products for installation.

B. Samples:

1. For mineral wool board insulation under slab, provide sample of submitted product (including planned installed thickness) for verification.
2. Attachment hardware: Cast in anchors for fastening insulation under first floor slab.
3.

C. Mockup:

1. Provide mockup of closed cell foam filled parapet section and exterior railing post.
2. Mockup shall include one 6 foot minimum section of parapet and two exterior railing posts minimum.
3. Intent of mockup is to establish the craftsmanship expected for this scope and shall be reviewed and approved by NPS Project ManagerNPS Project Manager/COR prior to installation of the remainder of this scope.
4. Work may be retained in the final work product provided it is accepted without changes by the NPS Project Manager/COR. Work that is not approved shall be removed from the project without damaging the surrounding materials.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes

less than Class A, 25 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

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

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

E. Thermal-Resistance Value (R-Value): R-value as indicated below in accordance with ASTM C518.

1. R-Value at Roof: R-38.

a. R-Value at Roof Above Deck: R-8ci
b. R-Value at Roof Framing Cavity: R-30

2. R-Value at Wood Framed Walls: R-20.
3. R-Value at Mass Floors: R-10ci.

F. Verify insulation complies with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less, except for insulation manufactured without formaldehyde.

2.2 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; complying with ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company
b. Or Approved Equal
c. Owens Corning
d. ROCKWOOL

2.3 MINERAL-WOOL BOARD INSULATION

A. Mineral-Wool Board Insulation, Types IA and IB, Unfaced: ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company
    b. Or Approved Equal
    c. Owens Corning
    d. ROCKWOOL

B. Mineral-Wool Board Insulation, Type IVB: ASTM C612, Type IVB; unfaced.

1. Nominal Density: 8 lb/cu. ft..
2. Basis of Design Product: Rockwool Comfortboard-80
3. Salient Characteristics:

    a. Moisture Sorption: 0.05% (per ASTM C1104)
    b. Water Vapor Transmission, Desiccant Method - 31 perm (per ASTM E96)
    c. Determination of Fungi Resistance - Passed (per ASTM C1338)
    d. Compressive Strength @ 10% compression: 439 psf (21 kPa) (per ASTM C165)
    e. Compressive Strength @ 25% compression: 1065 (50 kPa) (per ASTM C165)
    f. Flame Spread Index: 0 (per ASTM E84)
    g. Smoke Developed Index: 0 (per ASTM E84)
    h. Dimensional Stability: Linear Shrinkage - <0.5% @ 1200 deg F (per ASTM C356)

2.4 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. Carlisle Spray Foam Insulation.
    ii. Gaco; a brand of Firestone Building Products.
    iii. Johns Manville; a Berkshire Hathaway company.
    iv. NCFI Polyurethanes; a division of Barnhardt Manufacturing Company.
    v. SES Foam LLC.
    vi. Or Approved Equal.
2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    i. Flame-Spread Index: 25 or less.
    ii. Smoke-Developed Index: 450 or less.
3. Fire Propagation Characteristics: Passes NFPA 285 and NFPA 276 testing as part of an approved assembly.

B. Accessories:

1. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates. Provide primer from same manufacturer as the foamed in place insulation.
2. Ignition Barrier: Material providing a 15-minute minimum fire-ignition barrier.
    i. Gypsum Wallboard: 0.325-inch minimum thickness.

ii. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
iii. Flame-Spread Index: 25 or less
iv. Smoke-Developed Index: 50 or less

2.4 INSULATION FASTENERS

A. Insulation Fastener Accessories for Insulation Board Under Slab:

1. Provide stainless steel expansion bolts, 6 inch minimum length and 10-12 ga shank (coordinated with washer).
2. Provide stainless steel self-locking washers, 1.5 inch minimum diameter and inner diameter coordinated with expansion bolt.
3. Provide accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.
4. Note that contractor shall anticipate insulation under slab will need to be attached to slab with imbedded fasteners such that insulation shall not move if the sand beneath shifts away.

B. Insulation Fastener Accessories at All Other Mineral Wool Insulation Locations: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

2.5 VAPOR RETARDER

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Basis of Design: Stego Industries, LLC.
b. Barrier-Bac; Inteplast Group
c. Poly-America, L.P.
d. Raven Industries, Inc.
e. Reef Industries, Inc.
f. Tex-Trude.
g. Or Approved Equal.

2. Provide manufacturer's recommended adhesive or pressure-sensitive tape for sealing lap joints and tape or sealant for sealing around penetrations.

B. Manufacturer’s adhesive or pressure-sensitive tape for mechanical sealing of membrane to the cast concrete slab.

1. Basis of Design: Stego Crete Claw Tape
2. Salient Characteristics Materials: 6 inch wide, multi-layered film comprised of

polyethylene film, aperture film, and an acrylic, pressure-sensitive adhesive.

a. Total Thickness: 26 mil

3. Salient Characteristics Function: Applied to seams and along perimeter to bond vapor retarder to the under-side of the slab and holds it there after sand moves.

a. Permeance per ASTM F1249: 0.03 perms
b. 180 deg Adhesion Peel Strength per ASTM D903: 17.6 lbf/in
c. Shear Adhesion Strength: >49 lbf/in^2

2.6 ACCESSORIES

A. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
2. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.
3. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.
4. Clip-and-Pin Components:

a. Beam/Bar Joist Clips: For beams, bar joists, and Z-type purlins.
b. C-Purlin Clips: For C-type purlins.
c. Angle Clips: For sidewalks and floors.
d. Tube Clips: For wood beams and metal tubular framing.
e. Locking Washers: Aluminum; white to match reflective bubble insulation facing colors.

5. Wire Mesh Lath Support for Insulation: ASTM C1032.

a. Material: Woven wire lath 1-1/2-inch hexagonal-shaped mesh with minimum 0.0510-inch- diameter, galvanized-steel wire.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products,

applications and applicable codes.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. Install expansion bolts in insulation units and vapor retarder such that final product (likely flipped over from bolt installation) will have bolt/washer side down and expansion side expanded and facing up.

B. After flipping insulation units to right side up, seal penetrations in vapor retarder with tape or sealant.

C. Loosely lay insulation units in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

D. Tape seams in vapor retarder. Lap vapor retarder by 6 inches minimum.

E. Apply vapor retarder tape for adhesion to underside of cast concrete slab at vapor retarder perimeters and per manufacturer’s recommendations.

F. Expansion bolts facing up are intended to be embedded in the bottom of the slab when it is poured over the insulation and vapor barrier. These embedded fasteners will hold the board in place when the sand shifts over time.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with 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 the cavities, 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 not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For wood-framed construction, install blankets in accordance with ASTM C1320.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Mineral Wool Batt Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

3.5 INSTALLATION OF SPRAY FOAM INSULATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications

B. Spray insulation to envelop entire area to be insulated and fill voids

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members.

1. For parapets, entire cavity shall be filled to prevent moisture migration.

E. Steel Posts: Install into center of steel posts in lifts to ensure thorough fill. Foam that extrudes from holes / grommets in posts shall be cleaned off the steel and grommet material such that the railing has a professionally finished appearance.

F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

G. Install ignition barrier material where shown on drawings.

1. Do not cover insulation prior to any required spray foam insulation inspections.

H. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.

1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
2. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
3. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. 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 07 21 00

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR & WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes vapor-permeable, fluid-applied air and water barriers.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wall sheathing.
2. Section 06 20 13 “Exterior Finish Carpentry” for installation of redwood siding.
3. Section 07 62 00 “Sheet Metal Flashing and Trim” for self-adhered stainless steel and sheet metal flashing.
4. Section 07 92 00 “Joint Sealants” for joint sealants.

1.3 DEFINITIONS

A. Weather Barrier: A combination of materials and accessories that do the following:

1. Prevent the accumulation of water as a water-resistive barrier.
2. Minimize the air leakage into or out of the building envelope as a continuous air barrier.
3. Provide sufficient water vapor transmission to enable drying as a vapor permeable membrane.

B. Water-Resistive Barrier: A combination of materials and accessories that prevent the accumulation of water within the wall assembly in accordance with IBC Section 1403.2.

1. Primary Layer: Water-resistive barrier (fluid-applied) installed closest to building interior with all flashings and terminations integrated to this layer.
2. Secondary Layer: Outermost part of a double-layer system and where drainage is required behind claddings such as stucco, adhered masonry, and installation methods utilizing a lath.

C. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of building envelope in accordance with ASHRAE 90.1 Section 5.4.3.1.

D. Vapor-Permeable Membrane: The property of having a water-vapor permeance rating of 10 perms or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E 96 in accordance with definition in International Building Code. Vapor-permeable material permits passage of moisture vapor through vapor diffusion.

E. Vapor Diffusion: A slow movement of individual water vapor molecules from regions of higher to lower water vapor concentration (higher to lower vapor pressure).

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Contracting Officer, Manufacturer's Certified Installer, weather barrier manufacturer's designated field representative, and installers of work that interfaces with or affects weather barrier.
2. Review methods and procedures related to weather barrier installation, including manufacturer's written instructions.
3. Review and finalize construction, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine substrate conditions and finishes for compliance with requirements.
5. Review flashings, special weather barrier details, weather barrier penetrations, and condition of other construction that affects weather barrier.
6. Review weather barrier manufacturer's Project registration and observation process.
7. Review temporary protection requirements for weather barrier during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product required to affect a complete installation of a continuous air barrier system per the manufacturer’s installation instructions.

1. For weather barrier, include data on air and water-vapor permeance based on testing in accordance with referenced standards.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

C. Mockups

1. Provide mockups for the following:

a. Tower inset corner: ten foot by ten foot section minimum, including section at window jambs, sill, head, transition to foundation, and transition of building faces. Confirm location to be mocked up with Contracting Officer prior to mockup.
b. Parapet at low roof: six foot long minimum section of parapet, including transition of roofing to parapet flashing, over the parapet, and transition to weather barrier on face of building. Include mockup of one scupper location.
c. Parapet at tower third floor: six foot long minimum section of parapet, including transition of roofing to parapet flashing, over the parapet, and transition to weather barrier on face of building. Must include parapet corner at inset corners of

building and minimum one railing post.

2. See Quality Assurance section below for more information on mockup requirements.

D. Progress Images

1. Provide construction images of the installed air and weather barriers prior to installation of final finishes (siding, trim, coping, etc.).
2. Include photos of all parapets, window and door openings, and building corners.
3. Refer to section 013233 “Photo Documentation” for requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer's Instructions: For installation of each product specified.

B. Qualification Data: For Installer and field testing agency.

C. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

D. Sample Warranty: For manufacturer's warranty.

E. Reports: Field test and inspection reports.

F. Installer’s weather barrier manufacturer training certificate.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is certified by weather barrier system manufacturer to install manufacturer’s product.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly as indicated on Drawings, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

    a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
    b. Include fenestration and wall surface, junction with roofing membrane, building corner condition, and foundation wall intersection.
    c. If Contracting Officer determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Manufacturer's Field Service: Register Project with weather barrier manufacturer prior to installation of weather barrier and comply with weather barrier manufacturer's Project Registration and Observation process.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

C. Store in a dry environment between 50 and 80 deg F.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.10 WARRANTY

A. Manufacturer's Product Warranty: Manufacturer agrees to repair or replace weather barrier product that fails in materials within specified warranty period.

1. Warranty Period: 10 years from date of product purchase.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations: Obtain weather barrier assembly components, including weather barrier, weather barrier flashing, and foam insulation from same manufacturer as weather barrier or manufacturer approved by weather barrier manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed weather barrier and accessories shall withstand specified wind pressures, liquid water penetration, and water vapor pressures, without failure due to defective manufacture of products.

B. High-Performance Installations:

1. For installation with one of the following building envelope performance or structural characteristics:

    a. Exceeding 65 mph equivalent structural load.
    b. Exceeding 15 mph equivalent wind-driven rain water infiltration.
    c. Buildings with 60 feet or more total height above grade plane, as defined by the IBC.
    d. Construction with gypsum or cement-based exterior sheathing.
    e. Non-wood based primary structure such as steel, light-gauge steel, masonry, or concrete.

1.1 WEATHER BARRIER

A. Products:

1. Basis of Design: DuPont de Nemours Inc. Tyvek® Fluid Applied WB+™

2. Approved Comparable products:

    a. Carlisle Fire Resist Barrithane VP
    b. Grace Perm-A-Barrier VPL 50
    c. Or Approved Equal

B. Fluid-Applied Membrane: ASTM E 2357 passed, Air Barrier Association of America (ABAA) evaluated air barrier assembly, and assembly water resistance in accordance with ASTM E 331; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E 84; UV stabilized for nine-month exposure; and acceptable to authorities having jurisdiction.

1. Air Permeance, Product: Not more than 0.001 cfm/sq. ft. at 1.57 lbf/sq. ft. when tested in accordance with ASTM E 2178.
2. Air Permeance, Assembly: Not more than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. when tested in accordance with ASTM E 2357 and evaluated by the ABAA.
3. Water Penetration Resistance, Product: Hydrostatic-head resistance greater than 92.5 inches in accordance with AATTC 127.
4. Water Penetration Resistance, Assembly: Assembly wall specimen described in ASTM E 2357 to water resistance in accordance with ASTM E 331 to design pressures indicated on drawings.
5. Water-Vapor Permeance: Not less than 10 perms in accordance with ASTM E 96/E 96M, Desiccant Method (Procedure A) or not less than 20 perms in accordance with ASTM E 96/E 96M, Water Method (Procedure B).
6. Allowable UV Exposure Time: Not less than nine months, when tested in accordance with ASTM G 155 (accelerated weathering).

1.2 WEATHER BARRIER FLASHING

A. Conformable Weather Barrier Flashing: Composite flashing material composed of micro-creped, polyethylene laminate with a 100 percent butyl-based adhesive layer; AAMA 711 Class A (no primer), Level 3 thermal exposure of 176 deg F for seven days.

1. Basis-of-Design Product: DuPont™ FlexWrap™ NF

2. Approved Comparable Manufacturers:

    a. Carlisle Coatings & Waterproofing.
    b. GCP Applied Technologies.
    c. Or approved Equal

3. Conformability: Able to create a seamless sill pan extending up the jambs without cuts, patches, or fasteners.
4. Water Penetration: No leakage at 15 psf in accordance with ASTM E 331.
5. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. at 25 deg F as Class A (without primer use).
6. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in., after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3 Test B.

B. Strip Flashing: Composite flashing material composed of spunbonded polyethylene laminate with a 100 percent butyl-based adhesive layer; AAMA 711, Class A (no primer), Level 3 thermal exposure of 176 deg F for seven days.

1. Basis-of-Design Product: DuPont de Nemours Inc. Tyvek® StraightFlash™ Tyvek® StraightFlash™ VF

2. Approved Comparable Manufacturers:

    a. Carlisle Coatings & Waterproofing.
    b. GCP Applied Technologies.
    c. Or approved Equal

3. Water Penetration: No leakage at 15 psf in accordance with ASTM E 331.
4. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. at 25 deg F as Class A without primer use.
5. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in., after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3 Test B.

C. Primer for Flashings: Synthetic rubber-based product. Spray applied. Strengthen the adhesive bond at low temperature applications between weather products, such as self-adhered Flashing Products, Commercial Building Wraps, and common building sheathing materials.

1. Basis of Design Product: DuPont™ Adhesive Primer or comparable product by one of the following.

2. Approved Comparable Manufacturers:

    a. Carlisle Coatings & Waterproofing.
    b. GCP Applied Technologies.
    c. Or approved Equal

3. Peel Adhesion Test: Passes ASTM D 3330, Test Method F, for the following:

    a. Peel Angles: 0, 25, 72, and 180 degrees.

b. Substrates: Concrete masonry units (CMU), exterior gypsum sheathing, oriented strand board (OSB), aluminum, and vinyl.

4. Chemical Compatibility per AAMA 713: Pass.
5. Flame Spread Index per ASTM E 84: 5.
6. Smoke Development Index per ASTM E 84: 0.

1.3 FLUID APPLIED FLASHING AND SEALANT

A. Fluid Applied Flashing: Trowel or brush applied, non-water soluble, single component, silyl terminated polyether technology (STPE), vapor permeable, flashing material.

1. Basis-of-Design Product: DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound+

2. Approved Comparable Manufacturers:

a. Carlisle Coatings & Waterproofing.
b. GCP Applied Technologies.
c. Or Approved Equal

3. VOC Content: ASTM C 1250, less than 2 percent by weight and less than 30 g/L.
4. Water Vapor Transmission: ASTM E 96, Method B, greater than 20 perms at 25 mils thick.
5. Minimum Tensile Strength: ASTM D 412, 165 psi.
6. Minimum Elongation at Break: ASTM D 412, 360 percent.

B. Fluid Applied Sealant: ASTM C 920

1. Extension-Recovery/Adhesion per ASTM C 736: 100 percent recovery.
2. Accelerated Weathering/Low Temperature Flexibility per ASTM C 793: Pass.
3. VOC Percentage by Weight per ASTM C 1250: Less than 2 percent.
4. VOC per ASTM C 1250: Less than 30 g/L.

2.3 ACCESSORY MATERIALS

A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by weather barrier manufacturer.
3. Verify that substrates are visibly dry and frost-free.

    a. Fluid-applied weather barrier may be applied to damp surfaces.
    b. Surfaces are considered damp if there is no visible water on the surface, and no transfer of water to the skin when touched.
    c. Apply accessory products only to clean and dry surfaces.

4. Verify that substrates are free of efflorescence and mold.
5. Verify that masonry joints are flush and filled with mortar.
6. Verify that top-of-wall system has been capped or covered to prevent water getting behind the facade and into wall cavity.
7. Verify continuous path for moisture drainage.

    a. Verify that continuous path for drainage is not blocked or disrupted, which results in excess moisture buildup in wall cavity.

8. Verify that surfaces to receive weather barrier are above grade.

B. Verify that substrate and surface conditions are in accordance with commercial weather barrier manufacturer recommendations prior to installation.

1. Verify that rough sill framing for doors and windows slopes downward towards the exterior and is level across width of opening.

C. Verify air and surface temperatures are above 25 deg F with a maximum surface temperature of 140 deg F. Do not install once ambient temperature exceeds 95 deg F, unless surface is shaded.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another

with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

G. When spraying is method of application, taper ends of the joint treatment to assist maintaining a wall system free of pinholes and voids.

H. Treat all non-moving transition joints to beams, columns, and dissimilar materials by applying a 2-inch- wide by 60-mil- thick coat of fluid-applied flashing across the joint.

I. Apply 25-mil- thick coat of fluid-applied flashing, extending a minimum 2 inches on each surface, and treat the following conditions:

1. Joints up to 1/4 inch.
2. Joints 1/4- to 1/2-inch; reinforce with fiberglass-mesh tape.
3. Joints and transitions up to 1 inch; treat using strip flashing.

J. Bridge isolation joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

K. When spraying is method of application, taper ends of fluid applied corner treatment to wall substrate.

L. Treat inside and outside corners by applying a 25-mil- thick coat of fluid applied weather barrier a minimum 2 inches on each adjoining surface. Apply fillet bead of fluid-applied sealant to inside corners to ensure continuity. Alternatively, treat corners using strip flashing. Press strip flashing into inside corners; ensure that it is fully adhered to substrate.

M. Seal penetrations using fluid-applied flashing or sealant. Extend fillet bead 1/2 inch onto both surfaces.

N. Treat embedded masonry anchors by applying a coat of fluid-applied weather barrier or fluid-applied flashing around base of the anchor.

3.3 INSTALLATION OF ACCESSORIES

A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing, for a minimum 3 inches coverage over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow to dry.
4. Use recommended primer when applying self-adhered flashing products on concrete, masonry, and fiber faced exterior gypsum board substrates. Priming is generally not required for adhering self-adhered flashing products to wood. However, adverse weather conditions or colder temperatures may require a primer to promote adhesion. Priming is not required when applying fluid-applied products, except on cut edges of exterior gypsum

sheathing.

5. Apply pressure along entire surface of strip flashing for good bond using a J-roller or firm hand pressure. Remove all wrinkles and bubbles by smoothing surface and repositioning as necessary.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. When applying self-adhered flashing products over a cured fluid-applied membrane, first apply a wet bed of fluid-applied product.

D. Seal fasteners of mechanically attached supports or furring strips in high-performance building envelope designs.

1. Apply double-sided butyl tape to back of support bracket at fastener location.
2. Embed support bracket into an additional wet bed of fluid applied product.
3. Adhere butyl-based flashing patch to wall at fastener location.
4. Use alternate method as approved by the manufacturer.

E. At end of each working day, seal top edge of strips and transition strips to substrate with manufacturer approved product.

F. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Flashing Sill Area for Windows and Doors:

1. Use 6-inch- wide conformable flashing for 2- by 4-inch framing and 9-inch- wide conformable flashing for 2- by 6-inch framing. When rigid back dams are required or desired, one option to use is a 3/4-inch corner guard (back dam), cut to length of sill, and nailed into place on interior edge of sill prior to installation of 9-inch- wide conformable flashing. Afterward, install 9-inch- wide conformable flashing over sill and corner guard back dam.
2. Install without stretching conformable flashing when installing along sills or jambs. Conformable flashing is intended to be stretched when covering corners or curved sections.

H. Apply fluid-applied flashing products from head of opening down. Use a corner trowel to smooth corners.

I. Repairs:

1. Coat small damaged areas with layer of fluid-applied product.
2. Reinforce large damaged areas with fiberglass mesh or replace damaged substrate before reapplying fluid-applied product.

3.4 INSTALLATION OF PRIMARY AIR-BARRIER MATERIAL

A. Apply air-barrier material to form a seal with strips and transition strips, and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
4. Fluid applied products may be overcoated once a touch-free skin has formed. Exterior insulation and cladding may be installed once the membrane has cured sufficiently to resist damage during installation.

B. Apply air barrier material in accordance with air-barrier manufacturer's written instructions and recommendations.

1. Roller Application:

    a. Nap rolling: Use a roller cover with a 1/2- to 3/4-inch nap.

2. Spray Application:

    a. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
    b. Use spray guard.
    c. Back Rolling: Use a roller cover with a 1-1/2- to 3/4-inch nap. Apply fluid-applied product in a single coat at 25 mils thick. Control thickness by applying appropriate volume over a marked area and spot checking with a wet-mil gauge.

C. Integrate fluid-applied product with through-wall flashing and window and door flashing by overlapping flashing with fluid-applied product a minimum 2 inches.

D. Inspect surfaces to ensure that fluid-applied products are continuous and free of any voids or pinholes.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-

barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.

2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 07 54 19 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyvinyl chloride (PVC) roofing system.
2. Accessory roofing materials.
3. Roof insulation.
4. Insulation accessories
5. Walkways.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 072100 "Thermal Insulation" for insulation within roof structure.
3. Section 072726 “Fluid Applied Membrane Air & Weather Barriers” for adjacent weatherproofing materials.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for premanufactured copings.
6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 PRE-INSTALLATION SITE MEETING

1. Contractor to arrange for, document and facilitate meeting with NPS, Contractor, Window installer, Siding installer, Sheetmetal & Flashing installer, Roofing installer & Sealant Manufacturer’s Representative.

a. Confirm appropriate sealant for specific locations
b. Discuss sequence of installations
c. Confirm installer qualifications & methods
d. Installation and Testing of Mock-ups

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with NPS Project Manager/COR, Construction Manager, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Polyvinyl chloride (PVC) roofing system.
2. Accessory roofing materials.
3. Substrate board.
4. Vapor retarder.
5. Roof insulation.
6. Insulation accessories and cover board.
7. Walkway pads.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.

4. Tapered insulation thickness and slopes, including anticipated layout.
5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
6. Tie-in with air barrier.

C. Samples for Verification: For the following products:

1. Roof membrane and flashing, of color required.
2. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of compliance with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Evaluation Reports: For components of roofing system, from ICC-ES.

D. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.8 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
2. Warranty Period: 25 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.

1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. See Structural Drawings for Wind Loading information.

D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.

1. See Structural Drawings for Wind Loading information.

E. Energy Star Listing: Roofing system to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for low-slope roof products.

F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 POLYVINYL CHLORIDE (PVC) ROOFING SYSTEM

A. PVC Sheet Type III: ASTM D4434/D4434M, fabric reinforced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Syntec Systems
b. Cooley Group
c. Duro-Last Inc.
d. Elevate; Holcim Building Envelope

e. GAF
f. IB Roof Systems, Inc.
g. Johns Manville; a Berkshire Hathaway company
h. Mule-Hide Products Co., Inc
i. Or Approved Equal.
j. Soprema, Inc.
k. Versico Roofing Systems; Carlisle Construction Materials

2. Thickness: 60 mils.
3. Exposed Face Color: Gray is basis of design, submit standard color chart for NPS approval with shop drawings.
4. Roofing shall be considered a Fully Adhered System, as developed and warrantied by one manufacturer.

B. Source Limitations: Obtain components for roofing system from roof membrane manufacturer, or, manufacturers approved by roof membrane manufacturer.

2.3 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants shall comply with the following limits for VOC content:

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesives: 80 g/L.
f. PVC Welding Compounds: 510 g/L.
g. Other Adhesives: 250 g/L.
h. Single-Ply Roof Membrane Sealants: 450 g/L.
i. Nonmembrane Roof Sealants: 300 g/L.
j. Sealant Primers for Nonporous Substrates: 250 g/L.
k. Sealant Primers for Porous Substrates: 775 g/L.

3. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard.

E. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

F. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.

G. Slip Sheet: Manufacturer's standard, of thickness required for application.

H. Metal Termination Bars: Manufacturer's standard, predrilled 316 stainless steel bars, approximately 1 by 1/8 inch thick; with 316 stainless anchors.

I. Fasteners: 316 stainless steel fasteners and plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

1. Only stainless steel fasteners permitted.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 VAPOR RETARDER

A. Polyethylene Film: ASTM D4397, 10 mils thick, minimum, with maximum permeance rating of 0.76 perm.

1. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
2. Adhesive: Manufacturer's standard lap adhesive, listed by FM Approvals for vapor retarder application.

B. Butyl-Rubber-Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC roof membrane manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Atlas Polyiso Roof and Wall Insulation
b. Carlisle Syntec Systems
c. CertainTeed; SAINT-GOBAIN
d. Elevate; Holcim Building Envelope
e. GAF
f. Hunter Panels; a Carlisle company
g. Insulfoam; a Carlisle Company
h. Johns Manville; a Berkshire Hathaway company
i. Or Approved Equal
j. Rmax, A Business Unit of Sika Corporation

2. Compressive Strength: 20 psi.
3. Size: 48 by 48 inches.
4. Thickness:

a. Base Layer: 1-1/2 inches.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:

a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.6 INSULATION ACCESSORIES AND COVER BOARD

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: 316 Stainless steel fasteners and plastic plates designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer and NPS Project Manager/COR.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
2. Adhesives and sealants shall comply with the following limits for VOC content:

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesives: 80 g/L.
f. PVC Welding Compounds: 510 g/L.
g. Other Adhesives: 250 g/L.
h. Single-Ply Roof Membrane Sealants: 450 g/L.

i. Nonmembrane Roof Sealants: 300 g/L.
j. Sealant Primers for Nonporous Substrates: 250 g/L.
k. Sealant Primers for Porous Substrates: 775 g/L.

3. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch thick, having a minimum compressive strength of 80 psi.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

1. Size: Approximately 36 by 60 inches.
2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
4. Verify that adjacent cementitious wood-fiber panels are vertically aligned to within 1/8 inch at top surface.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when

no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.

1. Submit test result within 24 hours of performing tests.

a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."

3.4 INSTALLATION OF VAPOR RETARDER

A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
2. Continuously seal side and end laps with tape or adhesive.

B. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
2. Seal laps by rolling.

C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Wood and Wood Panel Decking:

1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to wood decks.

    a. Fasten slip sheet to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.

    a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    b. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    c. Fill gaps exceeding 1/4 inch with insulation.
    d. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    e. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to wood decks.

        1) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

3. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

    a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
    b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. Fill gaps exceeding 1/4 inch with insulation.
    f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    g. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss

Prevention Data Sheet 1-29, as follows:

1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

4. Confirm after installation complete that all areas of the roof have positive drainage (1/4” or greater) to the scuppers.

3.6 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. Apply roof membrane with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

3.7 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Install flexible walkways at the following locations:

   a. Perimeter of each rooftop unit.
   b. Between roof hatch and each rooftop unit location or path connecting rooftop unit locations.
   c. Top of the roof access ladder.
   d. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to NPS Project Manager/COR.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 19

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.

a. 316 Stainless Steel shall be the default material of choice.

2. Self-adhered flexible flashing – 316 Stainless Steel
3. Underlayment.
4. Miscellaneous materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 072726 “Fluid Applied Membrane Air & Weather Barriers” for adjacent water proofing materials.
3. Section 07 54 19 "Polyvinyl-chloride (PVC) Roofing" for installation of sheet metal flashing and trim integral with roofing.

1.2 PREINSTALLATION MEETINGS

A. PRE-INSTALLATION SITE MEETING

B. Contractor to arrange for, document and facilitate meeting with NPS, Contractor, Window installer, Siding installer, Sheetmetal & Flashing installer, Roofing installer & Sealant Manufacturer’s Representative.

1. Confirm appropriate sealant for specific locations
2. Discuss sequence of installations
3. Confirm installer qualifications & methods
4. Installation and Testing of Mock-ups

C. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For all sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details, including all coping, roof to wall flashings, scuppers, leader heads, leaders, straps, window & door heads, jambs, sills, door and window pans.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of roof-penetration flashing.
8. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
9. Details of special conditions.
10. Details of connections to adjoining work.
11. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.

1. Sheet Metal Flashing and Trim: Manufacturers' standard size. Include finished seam with required profile. Include fasteners, cleats, clips, closures, and other attachments. includes coping, roof to wall flashings, scuppers, leader heads, leaders, straps, window & door heads, jambs, sills, door and window pans.

D. Mockups

1. Provide mockups for the following:

a. Coping and flashing at parapet at tower third floor: six foot long minimum section of parapet, including parapet corner at inset corners of building and minimum one railing post.
b. Coping and flashing at scupper (may occur at main roof or tower third floor): six foot long minimum section of parapet, including parapet on both sides of one scupper and conductor head.

2. Mockup shall establish the level of craftsmanship required for all work under this specification.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless NPS Project Manager/COR specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion at the discretion of the NPS.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers with a demonstrated knowledge of SMACNA architectural details who custom fabricate sheet metal flashing and trim similar to that required for this Project. Installation shall conform to most current edition of SMACNA Architectural Sheet Metal Quality Assurance Guide.

1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless NPS Project Manager/COR specifically approves such deviations by Change Order.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 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.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to 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 are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Stainless Steel Sheet: ASTM A240/A240M, Type 316, dead soft, fully annealed.

1. Nominal Thickness: 0.0500 inch.
2. Surface: Smooth, flat.
3. Exterior Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

    a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
    b. Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

        1) Run grain of directional finishes with long dimension of each piece.
        2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Self-Adhering Stainless Steel Flashing:

1. Basis of Design: York 316 SA
2. Salient Characteristics:

    a. Type 316 for marine/coastal areas
    b. Bare stainless steel on non-adhesive side
    c. Butyl adhesive/watertight bond
    d. No primer required
    e. UV resistant
    f. 20 year warranty
    g. Extreme temperature resistant: stable and air tight from -70 degress F to 250 degrees F
    h. Fire resistant: ASTM E84 Class A material
    i. Mold resistant: passes ASTM D3273
    j. Air barrier test: passes ASTM E2178-13
    k. Bonds to: OSB, exterior gypsum, plywood, concrete, metals, and air barrier materials.
    l. Compatible with: Air barriers, spray polyurethane foam, insulation boards, dampproofing, PVC roofing, construction sealants.

2.3 UNDERLAYMENT

A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: High-strength 316 stainless steel
b. Blind Fasteners: High-strength 316 stainless steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: High-strength 316 stainless steel; with spike with ferrule matching internal gutter width.

2. Fasteners for Stainless Steel Sheet: Series 316 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

E. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. 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.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

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 cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Downspouts: Fabricate open-face downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Fabricated Hanger Style: Fig. 1-35H in accordance with SMACNA's "Architectural Sheet Metal Manual."
2. Fabricate from the following materials:

a. Stainless Steel: 0.0188 inch thick.

B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim,, and, built-in overflows. Fabricate from the following materials:

1. Conductor Head Profile: Fig. 1-25C
2. Stainless Steel: 0.025 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12 ft.- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: Fig. 3-4A in accordance with SMACNA's "Architectural Sheet Metal Manual."
2. Joint Style: Butted with expansion space and 6-inch- wide, exposed cover plate.
3. Fabricate from the following materials:

a. Stainless Steel: 0.0250 inch thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.0250 inch thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.0250 inch thick.

D. Flashing Receivers: Fabricate from the following materials:

1. Stainless Steel: 0.0250 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 ft. long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.0250inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings with 90 degree returns to waterproofing membrane on wall sheathing assembly at exterior door and window head trims. Form sill flashing with 4-inch- high end dams. Fabricate from the following materials:

1. Stainless Steel: 0.0250inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0250 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, 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.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. All Fasteners to be 316 Stainless Steel.
3. Hem all exposed edges.
4. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealants or solder.
5. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
6. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
7. Install continuous cleats with fasteners spaced not more than 12 inches on center.
8. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
9. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
10. Do not field cut sheet metal flashing and trim by torch.
11. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Underlayment: Where installing sheet metal flashing and trim directly on

cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in 316 Stainless Steel where necessary for strength.

3.3 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and equally spaced at approximately 60 inches on center.
4. Provide elbows at base of downspout to direct water away from building.

C. Parapet Scuppers:

1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
3. Loosely lock front edge of scupper with conductor head.

4. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge unless otherwise specified on plans.

3.4 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Copings:

1. Install copings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.

    a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
    b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.

4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as siding, windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings with 90 degree returns to waterproofing membrane on wall sheathing assembly at exterior door and window head trims. Form sill flashing with 4-inch- high end dams.

3.6 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

3.9 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim

manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. 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, as determined by NPS Project Manager/COR.

END OF SECTION 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:

1. Roof curbs.
2. Roof hatches.
3. Preformed flashing sleeves.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 06 10 00 "Rough Carpentry" for roof cants, nailers, blocking, and other pressure-preservative-treated wood.
3. Section 07 54 19 "Polyvinyl-Chloride (PVC) Roofing" for roofing material and walkways.
4. Section 07 71 00 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashing.
5. Section 07 92 00 "Joint Sealants" for field-applied sealants between roof accessories and adjacent materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof accessories in contact with other materials that might cause staining, denting, or other surface damage. Store roof accessories in accordance with

manufacturer's instructions.

B. Store materials off ground in dry location and in accordance with manufacturer's instructions in well-ventilated area.

C. Store and protect roof accessories from nicks, scratches, and blemishes.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-accessory substrates 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories to withstand exposure to Seaside salt laden Marine weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design roof curbs to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 ROOF CURBS

A. Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AES Industries, Inc
2. AES Sunoptics; Acuity Brands International, Inc.
3. Conn-Fab Sales, Inc
4. Custom Solution Roof and Metal Products, a division of Colony Heating

5. Metallic Products Corporation
6. RCS Fabrications Inc.
7. Roof Products and Systems (RPS); Duravent Group
8. Thybar Corporation
9. Vent Products Co., Inc
10. Or Approved Equal

C. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

D. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

E. Steel: 316 Stainless Steel: 0.0781 inch thick sheet.

1. Finish: Epoxy over factory Powder coat.
2. Color: White.

a. Color/finish to be confirmed with NPS Project Manager through submittal process.

F. Construction:

1. Curb Profile: 316 Stainless Steel compatible with roofing system.
2. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
3. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange, or, by use of leveler frame.
4. Sloping Roofs: Where roof slope exceeds 1/4 inch per 12 inches, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
5. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
6. Liner: Same material as curb, of manufacturer's standard thickness and finish.
7. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.
8. Wind-Restraint Straps and Base Flange Attachment: Provide wind-restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to comply with wind-uplift requirements.
9. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
10. Metal Counterflashing: 316 Stainless Steel, removable, fabricated of same metal and finish as curb.

2.3 ROOF HATCHES

A. Metal roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-

mounting flange at perimeter bottom.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ACUDOR Products, Inc
2. Babcock-Davis
3. BILCO Company (The)
4. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
5. Lexcor; a division of Luxsuco corp.
6. Metallic Products Corporation
7. Milcor by Duravent; Duravent Group.
8. Nystrom, Inc.
9. Or Approved Equal

C. Type and Size:

1. Single-leaf lid, 30 by 36 inches.

D. Loads

1. Minimum external live load and internal uplift load per design load requirements.
2. Refer to Structural Drawings for project design load requirements.

E. Hatch Material, 316 Stainless Steel

Thickness: Manufacturer's standard thickness for hatch size indicated.

1. Finish: Epoxy Coatings over Powder coat.
2. Color: White.

    a. Color/finish to be confirmed with NPS Project Manager through submittal process.

F. Construction:

1. Insulation: 1-inch- thick, cellulosic-fiber board or 1-inch- thick, glass-fiber board or 2-inch- thick, polyisocyanurate board.

    a. R-Value: 12.0 in accordance with ASTM C1363.

2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
6. Sloping Roofs: Where slope or roof deck exceeds 1/4 inch per 12 inches, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

G. Hardware: Spring operators, hold-open arm, 316 stainless steel spring latch with turn handles, 316 stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

H. Safety Railing System: Roof-hatch manufacturer's standard system, including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: 316 stainless steel pipe, 1-1/4 inches in diameter or 316 stainless steel tube, 1-5/8 inches in diameter.
3. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
4. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
6. Provide weep holes or another means to drain-entrapped water in hollow sections of handrail and railing members.
7. Fabricate joints exposed to weather to be watertight.
8. Fasteners: 316 Stainless Steel , finished to match railing system.
9. Finish: Epoxy Coatings over Factory Finish.

a. Color: White.
b. Color/Finish to confirmed with NPS Project Manager through submittal process.

I. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: 316 Stainless steel.
4. Post: 1-5/8-inch- diameter pipe.
5. Finish: Epoxy Coatings over Factory Finish.

a. Color: White.
b. Color/Finish to be confirmed by NPS Project Manager through submittal process.

2.4 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted, or perforated metal collar.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Custom Solution Roof and Metal Products, a division of Colony Heating
b. Thaler Metal Industries Ltd.
c. Or Approved Equal

2. Metal

a. Stainless Steel (316), 22 ga.

3. Diameter: As indicated on Drawings.
4. Finish: Manufacturer's standard.

2.5 MISCELLANEOUS MATERIALS

A. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 1, thickness as indicated.

B. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.

C. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

D. Fasteners: Roof accessory manufacturer's recommended fasteners, designed to comply with performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Stainless Steel Sheet: Series 316 stainless steel.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

F. Elastomeric Sealant: ASTM C920, elastomeric polyurethane, orsilicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - 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.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install roof accessories in accordance with manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.

1. Coat concealed side of stainless steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

3.3 INSTALLATION OF ROOF ACCESSORIES

A. Roof Curb: Install each roof curb so top surface is level.

B. Roof-Hatch:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post in accordance with manufacturer's written instructions.

C. Preformed Flashing-Sleeve and Flashing-Pipe Portal: Secure flashing sleeve to roof

membrane in accordance with flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane in accordance with roof membrane manufacturer's instructions.

D. Seal joints with elastomeric, or, butyl sealant as required by roof accessory manufacturer.

1. Confirm compatibility with roofing manufacturer.

3.4 CLEANING AND PROTECTION

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 099113 "Exterior Painting."

B. On completion of installation, clean exposed surfaces in according with manufacturer's written instructions. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by NPS Project Manager.

END OF SECTION 07 72 00

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SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Penetration firestopping systems.

B. Related Requirements:
1. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data: Penetration firestopping systems.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test in accordance with testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
         1) UL in its online directory "Product iQ."
         2) Intertek Group in its "Directory of Building Products."
         3) FM Approvals in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems are to be compatible with one another, with the substrates forming openings, and with penetrating items if any.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Building and Construction.
      b. Balco; a CSW Industrials Company.
      c. Everkem Diversified Products, Inc.
      d. Hilti, Inc.
      e. Holdrite; a division of Reliance Worldwide Corporation.
      f. Specified Technologies Inc.
      g. Tremco Incorporated.
      h. Or Approved Equal

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479 and ASTM E3037.
   1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.
   2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.
   3. M-Rating: compliant with ASTM 3037.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of the floor penetrated.

D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
   1. Permanent forming/damming/backing materials.
   2. Substrate primers.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.

G. 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.

H. Pillows/Bags: Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

K. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.

L. Firestop Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

M. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch in diameter.

N. Endothermic Wrap: Flexible, insulating, fire-resistant, endothermic wrap for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping 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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with 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 penetration firestopping materials.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming 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.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
   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 the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Where dropped ceiling exists, locate in ceiling plenum at least 15 feet from end of wall and at intervals not exceeding 30 feet.
   2. Where open to structure, locate above bottom chord of trusses, no lower and at least 15 feet from end of wall and at intervals not exceeding 30 feet.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping 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 penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

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SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Joints in or between fire-resistance-rated construction.
      a. Joint at edge of concrete slab perimeter
      b. Joints in rated walls.
      c. Joints where rated walls meet structure.

B. Related Requirements:
   1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
   2. Section 09 22 16 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Joints in or between fire-resistance-rated construction.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with Listed System Designs published by a qualified testing agency.
         1) UL in its online directory "Product iQ."
         2) Intertek Group in its "Directory of Building Products."

2.3 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
   1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
   2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
   3. Provide firestop products that do not contain ethylene glycol.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. 3M Building and Construction.
    b. Hilti, Inc.
    c. Owens Corning.
    d. ROCKWOOL.
    e. Tremco Incorporated.
    f. Or Approved Equal.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
    1. Verify sealant has a VOC content of 250 g/L or less.

2.4 ACCESSORIES

A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions 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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately 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 elastomeric fill materials or compromise fire-resistive rating.
    2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
    3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping 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. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition occurs.

3.3 INSTALLATION

A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
   3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft..

3.5 FIELD QUALITY CONTROL

A. Where deficiencies are found or joint firestopping systems are damaged, repair or replace joint firestopping systems so they comply with requirements.

B. Proceed with enclosing joint firestopping systems with other construction only after visual inspection conducted and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping 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 joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Nonstaining silicone joint sealants.
   3. Urethane joint sealants.
   4. Butyl joint sealants.

1.2 PRE-INSTALLATION SITE MEETING

A. Contractor to arrange for, document and facilitate meeting with NPS, Contractor, Window installer, Siding installer, Sheetmetal & Flashing installer, Roofing installer & Sealant Manufacturer's Representative.
   1. Confirm appropriate sealant for specific locations
   2. Discuss sequence of installations
   3. Confirm installer qualifications & methods
   4. Installation and Testing of Mock-ups

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Joint sealants.
   2. Joint sealant backing materials.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.4 CLOSEOUT SUBMITTALS

A. Joint Sealant Schedule, with manufacturers and colors identified for each location.

1.5 MOCKUPS

A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
   1. Requires approval of NPS Project Manager to proceed.

1.6 FIELD 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.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, 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 joint-sealant manufacturer, based on testing and field experience.

B. Sustainability:
   1. Confirm the compliance of all joint sealants with the requirements of Section 01 57 19.11 "Indoor Air Quality Management."

C. Manufacturers:
   1. Sika Corporation.
   2. Tremco Incorporated.
   3. Or Approved Equal.

D. Colors of Exposed Joint Sealants: As selected by NPS Project Manager to blend with adjacent materials. .

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.

2.4 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Bostik; Arkema.
      b. Pecora Corporation.
      c. Or Approved Equal.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Master Builders Solutions.
      b. Or Approved Equal.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) Type B (bicellular material with a surface skin) , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.6 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 performance of the Work.

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, 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. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 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 C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. 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.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. 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.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Exterior joints in horizontal traffic surfaces:
1. Joint Locations:
   a. Isolation and contraction joints in cast-in-place concrete slabs.
   b. Joints between concrete flatwork and building foundation.
2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by NPS Project Manager from manufacturer's full range of colors.

B. Exterior joints in vertical surfaces and horizontal nontraffic surfaces:
1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints in exterior insulation and finish systems.
d. Joints between metal panels.
e. Joints between different materials listed above.
f. Perimeter joints between materials listed above and frames of doors windows and louvers.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by NPS Project Manager from manufacturer's full range, design intent to match adjacent colors.

C. Interior joints in horizontal traffic surfaces:
1. Joint Locations:
a. Isolation joints in cast-in-place concrete slabs.
2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by NPS Project Manager from manufacturer's full range of colors.

D. Interior joints in vertical surfaces and horizontal nontraffic surfaces:
1. Joint Locations:
a. Tile control and expansion joints.
b. Vertical joints on exposed surfaces of walls and partitions.
2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by NPS Project Manager from manufacturer's full range of colors.

E. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces:
1. Joint Locations:
a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by NPS Project Manager from manufacturer's full range of colors.

F. Concealed mastics:
1. Joint Locations:
a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.
2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by NPS Project Manager from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 12 13 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel frames.

B. Related Requirements:

1. Section 08 14 16 "Flush Wood Doors" for door panels.
2. Section 08 22 00 "Fiberglass Reinforced Plastic (FRP) Doors And Frames" for doors and frames manufactured from FRP.
3. Section 08 36 13 “Sectional Doors” for garage doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation 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.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Interior steel frames.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, fire-resistance ratings, and finishes.

C. Shop Drawings: Include the following:

1. Elevations of each frame type.

2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
3. Locations of reinforcement and preparations for hardware.
4. Details of each different wall opening condition.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.

D. Samples for Initial Selection: For hollow-metal frames with factory-applied color finishes.

E. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

F. Product Schedule: For hollow-metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated hollow-metal frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to 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 frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; AADG, Inc.; ASSA ABLOY

2. Curries, AADG, Inc.; ASSA ABLOY Group
3. DCI Hollow Metal on Demand
4. Deansteel Manufacturing Company, Inc.
5. Steelcraft; Allegion plc
6. Or Approved Equal

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
2.

2.3 S STEEL FRAMES

A. Construct hollow-metal frames to comply with performance standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard Steel Frames: SDI A250.8. At locations indicated in the Door and Frame Schedule on Drawings.

1. Materials: Bituminous back coated teel sheet, minimum thickness of 0.067 inch.
2. Sidelite and Transom Frames: Fabricated from same thickness and material as adjacent door frame.
3. Construction: Knocked down.
4. Exposed Finish: Factory.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter 316 Stainless Steel bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide 316 Stainless Steel floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

2.5 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners:316 Stainless Steel

2.6 3FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite 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 welding, or by rigid mechanical anchors.
2. Provide countersunk, flat- or oval-head exposed 316 Stainless Steel screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, 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.

4. Terminated Stops: Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.

1. Color and Gloss - As selected by Contracting Officer from manufacturer's full range.

C. Field Applied Finish:

2.8 1. 2 coats epoxy paint as per NPS directive and paint specification in sec. 05 12 00.2.2.E. The product shall be NPS approved epoxy primer and finish coatings appropriate for exterior application and compatible over galvanized metal surfaces. Submit product data and physical representative sample for review and approval by the COR with shop drawings.

PART 3 - EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with SDI A250.11.

B. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

1. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
2. Install frames with removable stops located on secure side of opening.

C. Fire-Rated Openings: Install frames according to NFPA 80.

D. Floor Anchors: Secure with post installed expansion anchors.

E. Solidly pack mineral-fiber insulation inside frames.

F. Installation Tolerances: Adjust hollow-metal frames 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 at floor.

3.3 CLEANING AND TOUCHUP

A. 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.

B. Factory-Finish & Field Finish Touchup: Clean abraded areas and repair with same material used for factory/field finish according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 12 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Five-ply flush wood veneer-faced doors for stained finish.

B. Related Requirements:
1. Section 08 11 13 "Hollow Metal Doors and Frames" for steel frames.
2. Section 08 41 13 "Aluminum Framed Entrances and Storefronts" for aluminum frames.
3. Section 09 93 00 "Staining and Transparent Finishing" for field finishing doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door frame construction.
5. Factory-machining criteria.
6. Door Hardware, including closers, hinges, weather stripping and thresholds

B. Sustainable Design Submittals:

Demonstrate that wood door products are FSC certified by providing vendor invoices. Invoices will contain the vendor's Chain-of-Custody (COC) number and identify each FSC certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
2. Environmental Product Declaration: For each product.
3. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
4. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
1. Door schedule indicating door location, type, fire protection rating, size, and swing.
2. Door elevations, dimension, and locations of hardware, thresholds & weatherstripping.
3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
4. Dimensions and locations of blocking for hardware attachment.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.

7. Requirements for veneer matching.
8. Apply AWI Quality Certification Program label to Shop Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Special warranties.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 FIELD CONDITIONS

A. Environmental Limitations:
1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.
2. Do not deliver or install doors until building is enclosed and weathertight, 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 remainder of construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors and frames.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

2.3 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Provide labels from AWI certification program indicating that doors and frames comply with requirements of grades specified.
   2. Rating: Provide fire-rated or non-rated doors as noted in Drawings.

B. All wood products designated as "FSC certified" in this specification shall be certified according to the rules of the Forest Stewardship Council (www.fscus.org).

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

D. Composite Wood Products: Verify products are made without added urea formaldehyde.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Lambton Doors.
      b. Masonite Architectural.
      c. Oregon Door Company, Architectural Series.
      d. Oshkosh Door Company.
      e. VT Industries, Inc.
      f. Or Approved Equal.
   2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty .
   3. Architectural Woodwork Standards ANSI/WDMA I.S. 1A Grade: Custom.
   4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
      a. Species: Fir.
      b. Grade: Stain
      c. Cut: Plain sliced (flat sliced) .
      d. Match between Veneer Leaves: Book match.
   5. Core for Non-Fire-Rated Doors:
      a. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
   6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
      a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
   7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LOUVERS

A. Metal Louvers:
   1. Refer to mechanical louver schedule for specified louver.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
   5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Frames: For installation see Section 08 11 13 "Hollow Metal Doors and Frames" and 08 41 13 "Aluminum Framed Entrances and Storefronts.

C. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

D. Install frames level, plumb, true, and straight.
   1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
   2. Anchor frames to anchors or blocking built in or directly attached to substrates.
      a. Secure with countersunk, concealed fasteners and blind nailing.
      b. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

E. Job-Fitted Doors:
   1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware, thresholds & gasket seals.
3. After fitting and machining, immediately seal bottom and top of all doors with 2 coats epoxy penetrating sealer, immediately followed with painting top, bottom, edges and faces with 1 coat of primer and 2 coats finish.
4.
5. Seal edges of cutouts, hinge and lock mortises with 2 coats epoxy penetrating sealer immediately after fitting and machining.
6. Clearances:
   a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
   b. Provide 5/8”inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
   c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

F. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

3.4 INSPECTION

C. Contractor will commence inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

END OF SECTION 08 14 16

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SECTION 08 22 00 - FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Exterior Doors and Door Frames

a. Fiberglass Reinforced Plastic (FRP) Doors

b. Fiberglass Reinforced Plastic (FRP) Frames

B. Related Requirements:

1. Section 08 71 00 “Door Hardware” for door hardware.
2. Section 01 40 00 “Quality Requirements”

1.2 QUALITY ASSURANCE

A. General Qualifications:

1. Manufacturer Qualifications: A company that specializes in manufacturing FRP doors and frames with a minimum of 30 years experience.
2. Quality Assurance: Obtain all FRP doors and FRP frames from a single manufacturer to ensure consistent quality.
3. Quality Assurance: Hardware and accessories for all FRP doors and FRP frames shall exactly adhere to the specification.

B. Regulatory Requirements:

1. Fire-rated door, panel and frame construction conforms to products tested under ASTM E152, UL10C & NFPA 252.
2. Install doors, panels and frames conforming to NFPA 80 for fire-rated class, ANSI A117.1 specifications for handicap accessibility, ADA requirements, ANSI A250.4-2011 cycle swing in excess of 1,000,000 cycles with no failure of any design features of the door.
3. Flame Spread: All rated FRP component parts, including the finish, shall have a flame spread classification of 25 or less per ASTM E84 and shall be self extinguishing per ASTM D635, unless operating conditions dictate otherwise.
4. Resins and coatings to meet with USDA standards for incidental food contact, if applicable to this project.

C. Warranty:

1. To include ten (10) years free from defects in material and workmanship from date of shipment, and lifetime from corrosion from date of shipment, provided that the structural integrity of the doors and frames have not been violated or compromised.

1.3 SUBMITTALS

A. Shop Drawings – Include the following:

1. Elevation of each door type including door size, handing and finish
2. Cutout locations for 316 Stainless Steel hardware
3. Internal reinforcement
4. Frame configuration, anchor types and spacing
5. Weatherstripping & Thresholds

B. Product data for doors, thresholds, weatherstripping and all 316 Stainless Hardware including manufacturer's literature, fabrication descriptions and installation instructions.

C. Sample – 6x6 section of door panel with specified faces and core for verification.

1.4 DELIVERY, STORAGE AND PROTECTION

A. Doors and frames will be individually packaged in cardboard cartons. Cartons will be clearly labeled with project information and will include fasteners and installation instructions, if required. Only remove cartons upon arrival if cartons are wet or damaged.

B. Deliver and store doors and frames at the job site in such a manner as to prevent damage; out of weather and/or extreme temperatures. The doors shall be stored in a vertical position on blocking, clear of the floor and with blocking between the doors to permit air circulation between the doors.

C. All damaged or otherwise unsuitable doors and frames, when so ascertained, shall be immediately removed from job site.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design Manufacturer: CORRIM Company, Oshkosh, Wisconsin 54901. Phone: 920-231-2000 Fax: 920-231-2238 www.corrim.com

1. Or approved equal, given salient characteristics below.

B. Substitutions may be considered provided the manufacturer can comply with the specifications as written and the products are manufactured in the United States of America. Requests for substitutions must be submitted in writing no less than ten (10) business days prior to the bid date. Substitution requests shall include a physical sample and written documentation that the product meets the specific manufacturing methods as stated herein.

2.2 FRP DOORS

A. Door Fabrication:

1. Total door thickness to be a nominal 1-3/4 inches thick.
2. Lock stiles on non-rated and rated active leaves shall be factory beveled 1/8" in 2".
3. Provide doors with completely seamless construction on all six (6) surfaces.

B. Face Sheets: FRP face sheets shall be manufactured using a corrosion resistant resin system with light stabilizing additives. The resin shall be reinforced with fiberglass, 50% average by weight for enhanced strength. Face sheets shall be a minimum of 0.125 inch thick fiberglass.

C. Face Sheet Finish: Smooth.

D. Stiles and Rails: Stiles and rails shall be 1-1/2 inch square pultruded fiberglass tubes.

1. Pultrusion is a fiberglass fabrication process that results in a much stronger, more durable product.
2. Non-rated and 20 minute doors will have a full width horizontal 1-1/2 inch square pultruded fiberglass tube every 24 inches in height for internal reinforcement.
3. A 1-1/2 inch square solid fiberglass block shall be used at all hardware reinforcements and corner intersections.
4. A minimum of 1,000 pounds screw withdrawal force shall be required per screw.
5. The bottom rail shall allow for 1-1/4 inches of height alterability without loss of the panel's integrity.
6. Absolutely no metal or wood reinforcements, including #2 SPF (Spruce Pine Fir), will be allowed in any part of the stile and rail configuration.

E. Core:

1. Polyurethane Foam Core: A 1-1/2 inch thick rigid block of polyurethane shall be laminated to the interior of the panels. The "R" factor shall be 12. The polyurethane insulation shall be Class A and CFC free. Foam properties comply with ASTM E-84 and The International Building Code (IBC).

F. Hardware Preparations: Doors shall be reinforced and mortised for hardware with 1-1/2 inches x 1-1/2 inches of solid fiberglass to allow application of 316 Stainless Steel hinges and locks, in accordance with the hardware schedule, hardware manufacturer's instructions and templates.

1. Reinforcement Blocking: Non-swelling polymer or firestop blocking will be used for all lockset, surface mounted hardware and through bolted hardware blocking.
2. Pilot holes for full mortise butt hinges will be pre-drilled by factory.
3. All hardware shall be attached / installed by using pilot hole and 316 stainless steel wood screws.

G. Door Accessories

1. Louvers: Louvers shall be fabricated with pultruded FRP material of an inverted "V" design, and shall be subject to the same performance guarantee as the door panel. The louver opening will be fabricated in the same method as for glazing above.
2. Fasteners: Provide countersunk 316 stainless steel fasteners as required for glazing openings and louvers.
3. Astragals: Astragals for pairs of doors to be fabricated with FRP material of manufacturer's standard flat design.

2.3 FRP FRAMES

A. Fabrication: FRP frames shall be rigid, neat in appearance, free from defects and the finish shall match the doors. Fabricate FRP doors and frames as shown on the drawings and in accordance with best shop practices. Field measurements shall be taken as required for coordinating with adjoining work.

1. Provide frames for doors, transoms, sidelites and borrowed lites, as required.

2. All frames shall be 100% pultruded fiberglass with an average 50% glass content by weight which results in an industrial fiberglass frame as strong as a 14 gauge hollow metal frame.
3. Non-rated and 20 minute UL labeled: Standard one piece FRP profile with integral stop: 5-3/4" x 2" equal rabbet
    a. (optional: modified depth with equal rabbet)
    b. (optional: modified depth with un-equal rabbet)
    c. (optional: single rabbet design)
4. 30 – 90 minute UL labeled FRP Frames: Standard one piece FRP profile with integral stop: 5-3/4" x 2" equal rabbet. Frames that must be grouted solid with mortar in the field to achieve label are not acceptable.
5. Head and jamb members shall be standard 45 degree miter, providing a neatly mitered corner connection, fabricated for Knocked Down (KD) field assembly.
    a. (optional: one piece frame, resin bonded and assembled at factory, available on non-rated frames only)

B. Reinforcements and Braces / Supports

1. Frames shall be reinforced and mortised for hardware in accordance with the hardware schedule, manufacturer's instructions and templates. Absolutely no metal reinforcements will be allowed in any part of the FRP frame configuration.
2. Corner Reinforcement: 4 inches x 4 inches x 5-3/8 inches x 1/4 inch thick pultruded fiberglass angle. Attached to head bar at factory using 316 stainless steel screws.
3. Mortise Hinge Reinforcement: 3 inches x 7 inches x 9/16 inch (or 3/8 inch) thick FRP material attached to frame by means of bonding and 316 stainless steel countersunk screws.
4. Closer Reinforcement: 1-1/2 inches x 19 inches x 3/16 inch thick FRP material attached to frame by means of bonding.
5. Strike Reinforcement: 1-1/2 inches x 9 inches x 3/4 inch thick FRP material attached to frame by means of bonding and 316 stainless steel countersunk screws.
6. Anchoring Systems: Furnish at least three (3) anchors in each jamb of frames up to 90 inches high and one (1) additional anchor for each 30 inches in height above 90 inches, in shapes, sizes and spacing shown or required for anchorage into adjoining wall construction.
    a. New Stud (before sheathing): New Stud Anchor

2.4 FINISH

A. Factory finished.

B. Polyurethane finish, high solids polyurethane topcoat that exhibits excellent chemical resistance, outstanding toughness, flexibility, abrasion resistance and excellent outside durability.

1. Semi-Gloss; all face sheet options.
2. Gloss; smooth or pebble face sheets only.

C. Gelcoat Matte Finish, 25 mil (smooth face sheets only), from manufactures full range of colors.

D. Color to be selected by Contracting Officer from Manufacturer's Full Range.

E. Finish on door and frame units will match.

PART 3 – EXECUTION

3.1 INSPECTION

A. Installer shall examine the substrate and conditions under which fiberglass reinforced plastic work is to be installed and notify the General Contractor in writing of any conditions detrimental to the proper and timely completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 INSTALLATION

A. Doors and frames will be delivered in individual cartons with the identifying mark number listed on each carton.

B. Install FRP doors, frames and accessories in accordance with manufacturers printed instructions, final shop drawings, NFPA 80 standards at fire rated openings and / or HVHZ standards for FBC labeled openings.

C. Provide clearance for doors of 1/8 inch at jambs and heads; 1/4 inch clearance above threshold.

D. Fire labeled doors, frames and accessories must be installed by qualified, licensed installers adhering to the latest version of NFPA 80.

3.3 ADJUSTING

A. At substantial completion, adjust all operable components to ensure proper installation and compliance with ADA/ABAAS requirements.

B. Doors shall function smoothly and swing freely without binding.

C. Doors shall remain open at any angle without being affected by gravitational influence.

3.4 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.5 CLEANING

A. Remove dirt and excess sealant from exposed surfaces.

B. Follow the manufacturer’s recommended cleaning techniques and procedures for cleaning all surfaces.

C. Only use cleaning products that will not scratch or damage the surfaces and are recommended by the manufacturer.

PART 4 – Material Properties of Fiber Reinforced Plastic (FRP) Profiles

4.1 Door Properties

ASTM D-256: Notched Izod Impact

ASTM D-638: Tensile Strength Properties of Plastic

ASTM D-695: Compressive Strength

ASTM D-732: Shear Strength

ASTM D-790: Flexural Strength / Flexural Modulus

ASTM D-2583: Barcol Hardness

ASTM E-283: Air Infiltration Test

ASTM E-330: Static Load Test

ASTM E-331: Water Infiltration

ASTM E-1886: Impact by Missiles & Exposed to Cyclic Pressure Differentials

ASTM E-1996: Impact by Wind Borne Debris

TAS 201: Large Missile Impact

TAS 202: Static Load Test

TAS 203: Cyclic Load Test

SFBC 3603.2: Forced Entry

4.2 Foam Core Properties

ASTM C-203: Flexural Modulus

ASTM C-272: Water Absorption

ASTM C-273: Shear Strength

ASTM C-518: K-Factor / R-Factor

ASTM D-1621: Compressive Modulus

ASTM D-1622: Density

ASTM D-1623: Tensile Strength

ASTM D-2126: Dimensional Stability

ASTM D-2856: Closed Cell Content

ASTM E-84: Surface Burning Characteristics

ASTM E-96: Water Vapor Permeability

4.3 Adhesive Properties: Urethane Adhesive System

ASTM D-570: Water Absorption

ASTM D-638: Elongation Percent

ASTM D-638: Tensile Strength

ASTM D-638: Young's Modulus

ASTM D-2240: Shore Hardness, D

ASTM D-3163: Bond Configuration Lap Shear

ASTM E-132: Poisson Ratio

ASTM E-1640: Glass Transition Temperature

ISO MAT-2208: CLTE@ -30 to 0 deg. C

ISO MAT-2208: CLTE@ 50 to 100 deg. C

SAE J-1525: Crosshead Speed

END OF SECTION 08 22 00

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SECTION 08 31 13 – ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames - factory finished, color to match ceiling.
   2. Third floor ventilation access door (2/A5.4) hardware.
      a. Door panel is a custom FRP door panel per Section 08 22 00 “FRP Doors and Frames”.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ACUDOR Products, Inc.
      b. Babcock-Davis.
      c. Elmdor; Morris Group International, Inc.
      d. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
      e. Karp Associates, Inc.
      f. Metropolitan Door Industries Corp.
      g. MIFAB, Inc.
      h. Milcor; Hart & Cooley, Inc.
      i. Nystrom, Inc.
      j. Williams Bros. Corporation of America (The).
      k. Or Approved Equal.
   2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
   3. Optional Features: Gasketing.
   4. Locations:
      a. Exterior wall at Shower Rm 110. Coordinate final location with outdoor shower plumbing.
      b. Ceiling in Shower Rm 111. Coordinate access panel in Shower Rm 111 with installation of IT cabinet and enclosure.
   5. Door Size: As indicated on drawings except at plumbing shut off valves where 8" by 8" size required.
   6. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory finished.
   7. Frame Material: Same material and thickness as door.
   8. Latch and Lock: Cam latch, hex-head wrench operated.

2.2 CUSTOM ACCESS PANEL HARDWARE

A. Hinges
1. Provide two (2) hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
4. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
5. Recommend using same hinges purchased for 08 71 00 “Door Hardware”:
    a. Specified BOD: Ives 5BB series
    b. Or approved Equal

B. Opening Limiter
1. Provide two (2), one at either side of the access panel.
2. Material: Stainless steel
3. Limit arm: 5.5”
4. Track: 4.5”
5. Basis of Design: Truth Hardware, Stainless Steel Sash Stop Device (Swisco Product Code: 39-38SS)
    a. Or approved Equal

C. Cam Handle Lock
1. Provide one (1) at top of opening
2. Material: Zinc (Stainless steel preferred, but no product located)
3. Finish: Powder coated
4. Color to be selected by NPS Project Manager from manufacturer’s standard colors
5. Handle: 4” min.
6. Two part design: cam handle and receiver
7. Basis of Design: Allwin Zinc Window Lock Casement Window Cam Handle Lock (#913)
    a. Or approved Equal

D. Weatherstripping
1. Provide around entire opening
2. Size: .500” x .250”
3. Silicone bulb
4. Self-adhesive
5. Color to be selected by Contracting Officer from manufacturer’s standard colors
6. Recommend using same weatherstripping purchased for 08 71 00 “Door Hardware”:
    a. Specified BOD: Zero 188SBK PSA
    b. Equivalent products available from: National Guard or Pemko
    c. Or approved Equal

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 316 . Remove tool and die marks and stretch lines, or blend into finish.

E. Stainless Steel Flat Bars: ASTM A666, Type 316 . Remove tool and die marks and stretch lines, or blend into finish.

F. Aluminum Extrusions: ASTM B221, Alloy 6063.

G. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

H. Frame Anchors: Same material as door face.

I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view 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 mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.5 FINISHES

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

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.

a. Color: To match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 36 13 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sectional-door assemblies.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.
2. Section 061000 “Rough Carpentry” for wood framing and blocking for opening.
3. Section 079200 “Joint Sealants” for perimeter sealant.
4. Division 26 for electrical wiring and connections for door operator and controls.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, thresholds, weatherstripping, dimensions of individual components, profile door sections, and finishes.
2. For power-operated components, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of thresholds and weatherstripping
3. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
4. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
5. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sectional doors to include in maintenance manuals.

B. Manufacturer's warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with provisions in the United States Access Board's "Architectural Barriers Act (ABA) Standards" applicable to sectional doors.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship 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. Failure of components or operators before reaching required number of operation cycles.
   c. Faulty operation of hardware.
   d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
   e. Delamination of exterior or interior facing materials.
2. Warranty Period (Aluminum Frame): Twenty years from date of Substantial Completion.
3. Warranty Period (Door Track, Spring, Hardware): One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication,

installation, or other defects in construction.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Drawings.
2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
    a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
    b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.
4. Operability under Wind Load: Design sectional doors to remain operable under design wind load, acting inward and outward.

C. Seismic Performance: Provide sectional doors that withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. Component Importance Factor: 1.0.

2.3 SECTIONAL-DOOR ASSEMBLY

A. Sectional Door: Provide vinyl sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

1. Basis of Design Product - Armrlite Fiberglass and Aluminum Garage Door
2. Manufacturers: Subject to compliance with salient characteristics listed below, provide products by one of the following:
    a. Arm-R-Lite Manufacturing Co., Inc.
    b. Overhead Door Corporation
    c. Or Approved Equal

B. Operation Cycles: Door components and operators capable of operating for not less than 100,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Finish and Color: Clear anodized aluminum and translucent fiberglass panels.

D. Door Assembly: Stile and rail assembly secured with concealed heli-arch welds. Through rods, bolts, and self-tapping screw construction methods will not be accepted.

1. Panel Thickness: 1-3/4 inches
2. Center Stile Width: 3-3/8 inches
3. End Stile Width: 7-1/2 inches
4. Meeting Rail Pair Width: 3-3/8 inches wide per pair
5. Top Rail Width: 7-1/2 inches
6. Bottom Rail Width: 7-1/2 inches

7. Aluminum Panels: 0.5 inch insulated aluminum panels
8. Stiles and Rails to be constructed of 4-sided .075-.085 extruded 6063 T6 aluminum alloy
    a. Energy Efficiency Package: Polyurethane expanding foam filled insulated rails and stiles with water resistant feature.
9. Springs: 100,000 cycles
10. Glazing: Translucent insulated fiberglass panels

E. Track: Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Basis of design: Armrlite Type 316 Stainless Steel Corrosion Resistant Option
2. Material - Type 316 Stainless Steel
3. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
4. Track Reinforcement and Supports: Provide type 316 Stainless-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
    a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle, or continuous reverse angle attached to track and wall.
    b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

F. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top, and, jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.

G. Hardware: Heavy-duty, corrosion-resistant hardware, with type 316 Stainless steel fasteners, to suit door type.

1. Hinges: Heavy-duty,type 316 Stainless-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
    a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
    b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
    a. Roller-Tire Material: Neoprene.

3. Push/Pull Handles: Equip each door with type 316 Stainless-steel lifting handles on each side of door, finished to match door.

H. Locking Device:

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
    a. Lock Cylinders: Cylinders standard with manufacturer.
    b. Keys: Three for each cylinder.
3. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

I. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
    a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
    b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.
3. Cables: Type 316 Stainless-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

J. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Operator Basis of Design - Liftmaster MT, medium duty logic trolley operator
3. Control Device and device location to comply with ABAAS accessibility requirements.
4. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
5. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if

exposed and mounted at 8 ft. or lower.

6. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
7. Operator Type: Trolley.
8. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
    a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
    b. Electrical Characteristics:
        1) Phase: Single phase.
        2) Volts: 115 V.
        3) Amperes: 20 A
9. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
10. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
    a. Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
    b. Unmonitored Entrapment Protection: Pneumatic sensor edge, black, located within weatherseal mounted to bottom bar.
11. Control Station: Surface mounted, three-position (open, close, and stop) control.
    a. Operation: Push button.
    b. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
    c. Features: Provide the following:
        1) Radio-control operation.
        2) Explosion- and dust-ignition-proof control wiring.
        3) Audible and visual signals that comply with regulatory requirements for accessibility.
12. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.
13. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
14. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
3. Secure tracks to structural members only.

E. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

F. Power-Operated Doors: Install automatic garage door openers in accordance with UL 325.

G. Install perimeter trim and closures.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING AND CLEANING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Tolerances: Maintain dimensional tolerances and alignment with adjacent work.

1. Maximum variation from plumb: 1/8 inch.
2. Maximum variation from level: 1/8 inch.
3. Longitudinal or diagonal warp: plus or minus 1/8 inch from 10 foot straight edge.

E. Clean doors, frames, and glass.

3.5 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

B. Protect installed products until completion of project.

C. Touch-up damaged coatings and finishes and repair minor damage before Substantial Completion.

1. If major damage occurs, damaged component shall be replaced with new.

3.6 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13

SECTION 08 41 13 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum-framed storefront systems.

B. Related Requirements:
   1. Section 07 60 00 "Sheet Metal Flashing and Trim"
   2. Section 07 92 00 "Joint Sealants"
   3. Section 08 71 00 "Door Hardware."
   4. Section 08 80 00 "Glazing"

C.

1.2 POST MOBILIZATION SITE MEETING

No later than 14 days after project mobilization, Contractor to schedule, arrange for, document with meeting notes and facilitate on site meeting with NPS Project Manager, Contractor, Window installer, Window Manufacturer's Representative, Siding installer, Sheetmetal & Flashing installer & Sealant Manufacturer's Representative.

Agenda Items:

1. Sequence of installations by trade
2. Installer's materials & methods
3. Shop Drawing preparation
4. Appropriate sealant for specific locations
5. Mockups, inspections and testing
6. Schedule milestone targets

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Aluminum-framed entrance and storefront systems.
      a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

Shop Drawings: Conduct meeting at Project site to review submitted shop drawings prior to approval. Contractor to arrange for, document and facilitate meeting with NPS, Contractor, Window installer, Window Manufacturer's Representative, Siding installer, Sheetmetal & Flashing installer & Sealant Manufacturer's Representative.

   2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.

3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:
    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Flashing and drainage.
4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Point-to-point wiring diagrams showing the following:
    a. Power requirements for each electrically operated door hardware.
    b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: For aluminum-framed entrance and storefront systems, accessories, and components, from manufacturer.
1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront system.

B. Sample Warranties: For aluminum-framed entrance and storefront systems.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.

B. Warranty documentation.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Entity that employs installers and supervisors who are trained and approved by manufacturer.
2. Authorized representative who is trained and approved by manufacturer.

B. Manufacturer Qualifications:
1. A manufacturer capable of providing aluminum framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations. Manufacturer has documented five years' experience.
2. Testing: Field testing under negative pressure as per ASTM E1105-15 shall be performed by a third party certified agency, approved by the NPS and employed by contractor, to verify installation can withstand water spray test with 8.0 psf of negative pressure at 5GPH/ft2 for 15 minutes with no water intrusion on 3 installed window assemblies as determined by the NPS Project Manager.
3.

C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to NPS Project Manager..

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

B. Structural Loads:
   1. Wind Loads: As indicated on Structural Drawings.
   2. Other Design Loads: As indicated on Structural Drawings

C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of 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.
   2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
      a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
   3. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers.

D. Structural: Test in accordance with ASTM E330/E330M as follows:
   1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or 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. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.

F. Seismic Performance: Aluminum-framed entrance and storefront systems to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 Seismic Design Category D.
   1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.

G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
   1. Thermal Transmittance (U-factor):
      a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
      b. Entrance Doors: U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
   2. Reflective Solar Heat-Gain Coefficient (RSHGC):
      a. Fixed Glazing and Framing Areas: RSHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.
      b. Entrance Doors: RSHGC of not more than 0.23 as determined in accordance with NFRC 200.
   3. Visible Transmittance (VT):
      a. Fixed Glazing and Framing Areas: VT of not less than 0.46.
      b. Entrance Doors: VT of not less than 0.17.
   4. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
b. Entrance Doors: Air leakage of not more than 0.3 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

5. Condensation Resistance Factor (CRF):
a. Fixed Glazing and Framing Areas: CRF for the system of not less than 65 as determined in accordance with NFRC 500.
b. Entrance Doors: CRF of not less than 65 as determined in accordance with NFRC 500.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.
c. Interior Ambient-Air Temperature: 75 deg F.

2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Arcadia, Inc.
2. EFCO Corporation.
3. Kawneer Company, Inc.; Arconic Corporation.
4. Manko Window Systems, Inc.
5. Old Castle Building Envelope (OBE).
6. Tubelite Inc.
7. Or Approved Equal.

B. Basis of Design: Arcadia AFG451T Series, center glazed. For salient characteristics, refer to section 2.2.

C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: thermally broken.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Glazing Plane: Center Glazed.
5. Finish: Color anodic finish; Basis of Design: Dark Bronze Anodized, Final color selection to be confirmed by NPS Project Manager.
6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

G. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

H. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

I. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

J. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

K. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
   1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
      a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
   2. Door Design: Wide stile; 5-inch nominal width.
   3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide nonremovable glazing stops on outside of door.
   4. Finish: Match adjacent storefront framing finish.

2.4 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

A. Steel Reinforcement: Where reinforcing provided, Manufacturer to provide 316 stainless steel reinforcing, ASTM A276.

2.5 FABRICATION

A. Form or extrude 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. 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. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior interior.
   6. 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. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At interior and exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.6 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

B. Color: Basis of Design: Clear anodized. Final color selection to be by NPS Project Manager from manufacturer's full range of colors.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads finished to match framing system.

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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

K. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

L. Install entrance doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

M. Install glazing as specified in Section 08 80 00 "Glazing."

N. Install structural glazing as follows:
   1. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
   2. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
   3. Set glazing with proper orientation so that coatings face exterior or interior as specified.
   4. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
   5. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.
   6. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
   7. Allow structural sealant to cure in accordance with manufacturer's written instructions.
   8. Clean and protect glass as indicated in Section 08 80 00 "Glazing."
   9. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
   10. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
   2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
   4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Tests: Perform the following tests on representative areas of aluminum-framed entrance and storefront systems .
   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by NPS Project Manager to be tested in accordance with AAMA 501.2 and to not evidence water penetration.
      a. Perform a minimum of two tests in areas as directed by NPS Project Manager.
      b. Perform tests in each test area as directed by NPS Project Manager. Perform at least three tests, prior to 10, 35, and 70 percent completion .

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
    a. Perform a minimum of two tests in areas as directed by NPS Project Manager.
    b. Perform tests in each test area as directed by NPS Project Manager. Perform at least three tests, prior to 10, 35, and 70 percent completion .
3. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and to not evidence water penetration.
4. Testing: Field testing under negative pressure as per ASTM E1105-15 shall be performed by a third party certified agency, approved by the NPS and employed by contractor, to verify installation can withstand water spray test with 8.0 psf of negative pressure at 5GPH/ft2 for 15 minutes with no water intrusion on 3 installed window assemblies as determined by the NPS Project Manager.

C. Inspection Agency: Engage a qualified inspector to perform inspections.

D. Inspections:
1. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
2. Accessibility Inspection: Contractor will commence inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

E. Aluminum-framed entrance and storefront systems will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 08 41 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glazed aluminum curtain wall systems:

a. Two-sided, structural-sealant-glazed.

B. Related Requirements:

1. Section 08 41 13 “Aluminum Framed Entrances and Storefronts” for adjacent aluminum door.
2. Section 088000 "Glazing" for curtain wall glazing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Requires attendance of Contractor, curtain wall installer, representative from curtain wall manufacturer, Construction Manager, and Contracting Officer.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor

barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.6 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

A. Special Assembly Warranty: Installer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or

workmanship 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 created by wind and thermal and structural movements.
    c. Deterioration of metals and other materials beyond normal weathering.
    d. Water penetration through fixed glazing and framing areas.
    e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    c. Cracking, peeling, or chipping.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.
    e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans of greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or 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.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..

G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..
2. Maximum Water Leakage: In accordance with AAMA 501.1. Water leakage does not include water controlled by flashing and gutters or water that is drained to exterior.

H. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.

I. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat Gain Coefficient (SHGC):

a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 65 as determined in accordance with AAMA 1503.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.

K. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

L. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 SOURCE LIMITATIONS

A. Obtain all components of curtain-wall system and storefront system, including framing spandrel panels, entrances and accessories, from single manufacturer.

2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arcadia, Inc.
2. EFCO Corporation
3. Kawneer Company, Inc.; Arconic Corporation
4. Or Approved Equal

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
3. Glazing Plane: Front.
4. Finish: Clear anodic finish.
5. System: Either stick or unitized system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Insulated Spandrel Panels:

1. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

a. Overall Panel Thickness: 1 inch.
b. Exterior Skin: Aluminum.

1) Thickness: Manufacturer's standard for finish and texture indicated.
2) Finish: Match framing system.
3) Texture: Smooth.
4) Backing Sheet: 0.157-inch- thick, cement board.

c. Interior Skin: Aluminum.

1) Thickness: Manufacturer's standard for finish and texture indicated.
2) Finish: Matching curtain-wall framing.
3) Texture: Smooth.
4) Backing Sheet: 1/2-inch- thick, gypsum board with proprietary fire-resistance-rated core.

d. Thermal Insulation Core: Manufacturer's standard expanded-perlite, mineral-insulation board.
e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 50 or less.

F. Entrance Door Systems: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts".

2.4 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard.

1. Color: Black.

C. Glazing Sealants: As recommended by manufacturer.

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.

1. Color: Gray or As selected by Contracting Officer from manufacturer's full range of colors.

E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.

1. Color: Match structural sealant.

2.5 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement: Where reinforcing provided, Manufacturer to provide 316 stainless steel reinforcing, ASTM A276.

E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

F. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, ASTM A240/A240M of type recommended by manufacturer.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude 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. 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. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing

to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

F. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
3. Seal joints watertight unless otherwise indicated.
4. Install glazing to comply with requirements in Section 088000 "Glazing."
5. Install structural glazing.

a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
b. Set glazing with proper orientation so that coatings face exterior or interior as specified.
c. Apply structural silicone sealant to completely fill cavity, in accordance with sealant manufacturers written instructions with the framing and glazing in a fully supported position.
d. Brace or stiffen framing and glazing in such a manner to prevent undue stresses on the glass edge seal and structural joints or movement of the glazing, until sealant is fully cured in accordance with manufacturer's recommendations.
e. After structural sealant has completely cured, insert backer rod between lites of glass as recommended by sealant manufacturer.
f. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.
g. Clean and protect glass as indicated in Section 088000 "Glazing."
h. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.

G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611 AA-M12C22A41, Class I, 0.018 mm or thicker.

2.9 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.

G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.4 INSTALLATION OF STRUCTURAL GLAZING

A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

B. Set glazing into framing in accordance with sealant manufacturer's and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.

C. Set glazing with proper orientation, so that coatings face exterior or interior as specified.

D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.

E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer's and framing manufacturer's written instructions and in compliance with local codes.

F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.

G. Allow structural sealant to cure in accordance with manufacturer's recommendations.

H. Clean and protect glass as indicated in Section 088000 "Glazing."

3.5 INSTALLATION OF WEATHERSEAL SEALANT

A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass, as recommended by sealant manufacturer.

B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.6 ERECTION TOLERANCES

A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
    a. For the portions of the work that are intentionally installed at an angle, see drawings.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.7 FIELD QUALITY CONTROL

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

B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.

C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Contracting Officer shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.

a. Perform a minimum of two tests in areas as directed by Contracting Officer.
b. Perform tests in each test area as directed by Contracting Officer. Perform at least three tests, prior to 10, 35, and 70 percent completion.

D. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

1. Test a minimum of four areas on each building facade.
2. Repair installation areas damaged by testing.

E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 08 44 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glazed aluminum curtain wall systems:

a. Two-sided, structural-sealant-glazed.
b. Tower and similar applicible assemblies as determined by the Owner.

B. Related Requirements:

1. Section 08 41 13 “Aluminum Framed Entrances and Storefronts” for adjacent aluminum door.
2. Section 088000 "Glazing" for curtain wall glazing.

1.2 PREINSTALLATION MEETINGS

A. No later than 14 days after project mobilization, Contractor to schedule, arrange for, document with meeting notes and facilitate on site meeting with NPS Project Manager, Contractor, Window installer, Window Manufacturer’s Representative, Siding installer, Sheetmetal & Flashing installer & Sealant Manufacturer’s Representative.

Agenda Items:

1. Sequence of installations by trade
2. Installer’s materials & methods
3. Shop Drawing preparation
4. Appropriate sealant for specific locations
5. Mockups, inspections and testing
6. Schedule milestone targets

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.6 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings or as directed by NPS Project Manager,

2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless NPS Project Manager specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

A. Special Assembly Warranty: Installer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship 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 created by wind and thermal and structural movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.
    e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans of greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or 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.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..

G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when

tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..

2. Maximum Water Leakage: In accordance with AAMA 501.1. Water leakage does not include water controlled by flashing and gutters or water that is drained to exterior.

H. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.

I. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat Gain Coefficient (SHGC):

a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 65 as determined in accordance with AAMA 1503.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.

K. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

L. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 SOURCE LIMITATIONS

A. Obtain all components of curtain-wall system and storefront system, including framing spandrel panels, entrances and accessories, from single manufacturer.

2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arcadia, Inc.
2. EFCO Corporation
3. Kawneer Company, Inc.; Arconic Corporation
4. Or Approved Equal

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
3. Glazing Plane: Front.
4. Finish: Clear anodic finish.
5. System: Either stick or unitized system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Insulated Spandrel Panels:

1. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

    a. Overall Panel Thickness: 1 inch.
    b. Exterior Skin: Aluminum.

        1) Thickness: Manufacturer's standard for finish and texture indicated.
        2) Finish: Match framing system.
        3) Texture: Smooth.
        4) Backing Sheet: 0.157-inch- thick, cement board.

    c. Interior Skin: Aluminum.

        1) Thickness: Manufacturer's standard for finish and texture indicated.
        2) Finish: Matching curtain-wall framing.
        3) Texture: Smooth.
        4) Backing Sheet: 1/2-inch- thick, gypsum board with proprietary fire-resistance-rated core.

    d. Thermal Insulation Core: Manufacturer's standard expanded-perlite, mineral-insulation board.
    e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.

F. Entrance Door Systems: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts".

2.4 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard.

1. Color: Black.

C. Glazing Sealants: As recommended by manufacturer.

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant

manufacturer for use in curtain-wall assembly indicated.

1. Color: Gray or As selected by NPS Project Manager from manufacturer's full range of colors.

E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.

1. Color: Match structural sealant.

2.5 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement: Where reinforcing provided, Manufacturer to provide 316 stainless steel reinforcing, ASTM A276.

E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

F. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, ASTM A240/A240M of type recommended by manufacturer.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude 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. 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. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

F. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
3. Seal joints watertight unless otherwise indicated.
4. Install glazing to comply with requirements in Section 088000 "Glazing."
5. Install structural glazing.

a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
b. Set glazing with proper orientation so that coatings face exterior or interior as specified.
c. Apply structural silicone sealant to completely fill cavity, in accordance with sealant manufacturers written instructions with the framing and glazing in a fully supported position.
d. Brace or stiffen framing and glazing in such a manner to prevent undue stresses on the glass edge seal and structural joints or movement of the glazing, until sealant is fully cured in accordance with manufacturer's recommendations.
e. After structural sealant has completely cured, insert backer rod between lites

of glass as recommended by sealant manufacturer.

f. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

g. Clean and protect glass as indicated in Section 088000 "Glazing."

h. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.

G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611 AA-M12C22A41, Class I, 0.018 mm or thicker.

2.9 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

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 the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.

G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.4 INSTALLATION OF STRUCTURAL GLAZING

A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

B. Set glazing into framing in accordance with sealant manufacturer's and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.

C. Set glazing with proper orientation, so that coatings face exterior or interior as specified.

D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.

E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer's and framing manufacturer's written instructions and in compliance with local codes.

F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.

G. Allow structural sealant to cure in accordance with manufacturer's recommendations.

H. Clean and protect glass as indicated in Section 088000 "Glazing."

3.5 INSTALLATION OF WEATHERSEAL SEALANT

A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass, as recommended by sealant manufacturer.

B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.6 ERECTION TOLERANCES

A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
    a. For the portions of the work that are intentionally installed at an angle, see drawings.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.7 FIELD QUALITY CONTROL

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

B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.

C. Field Quality-Control Testing: Perform the following test(s) on representative areas of glazed aluminum curtain walls as directed by NPS Project Manager

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by NPS Project Manager shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.

2. Testing: Field testing under negative pressure as per ASTM E1105-15 shall be performed by a third party certified agency, approved by the NPS, employed and managed by contractor, to verify installation can withstand water spray test with 8.0 psf of negative pressure at 5GPH/ft2 for 15 minutes with no water intrusion on 3 installed window assemblies as determined by the NPS Project Manager.

    a. Perform tests in each test area as directed by NPS Project Manager. Perform at least three tests, prior to 10, 35, and 70 percent completion.

D. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

1. Test a minimum of four areas on each building facade.
2. Repair installation areas damaged by testing.

E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 08 44 13

SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum windows.

1.2 COORDINATION

A. Finish Matching: Coordinate all exposed exterior aluminum components and trim to ensure uniform and consistent color and appearance. Use products specified in Section 08 41 13 Aluminum Framed Entrances and Storefronts as a benchmark. NPS Project Manager's decision will be final as to whether a proposed product matches.

1.3 POST MOBILIZATION SITE MEETING

A. No later than 14 days after project mobilization, Contractor to schedule, arrange for, document with meeting notes and facilitate on site meeting with NPS Project Manager, Contractor, Window installer, Window Manufacturer’s Representative, Siding installer, Sheetmetal & Flashing installer & Sealant Manufacturer’s Representative.

Agenda Items:

1. Sequence of installations by trade
2. Installer’s materials & methods
3. Shop Drawing preparation
4. Appropriate sealant for specific locations
5. Mockups, inspections and testing
6. Schedule milestone targets

1.4 SHOP DRAWING REVIEW MEETING

Conduct meeting at Project site to review submitted shop drawings prior to approval. Contractor to arrange for documentation of and facilitate meeting with NPS, Contractor, Window installer, Window Manufacturer’s Representative, Siding installer, Sheetmetal & Flashing installer & Sealant Manufacturer’s Representative.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss finishing of aluminum windows that is required to be coordinated with finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate shop drawing details depicting interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
4. Review and discuss sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings:

1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples for Verification: Actual sample of finished products for each type of exposed finish:

1. Exposed Aluminum Finishes: Manufacturers' standard size.
2. Exposed Hardware: Full-size units.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each aluminum window, for tests performed by qualified testing agency.

B. Sample warranties.

1.7 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: Authorized representative who is trained and approved by aluminum window manufacturer.

C. Testing: Field testing under negative pressure as per ASTM E1105-15 shall be performed by a third party certified agency, approved by the NPS, employed and managed by contractor, to verify installation can withstand water spray test with 8.0 psf of negative pressure at 5GPH/ft2 for 15 minutes with no water intrusion on 3 installed window assemblies as determined by the NPS Project Manager.

D. Testing Agency Qualifications: An FGIA-accredited testing agency and as approved by the NPS for testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum windows to Project site in original, unopened packages and store them in accordance with manufacturer's written instructions. Protect aluminum windows against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle aluminum windows in a manner that prevents damage before, during, and after installation.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install aluminum windows outside of limits recommended in writing by manufacturer.

1.11 WARRANTY

A. Special Warranty: Contractor agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures, including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Hardware: Three years from date of Substantial Completion.
d. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain aluminum windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: FGIA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: AW.
2. Minimum Performance Grade: 50.

C. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:

a. Fixed Windows: Not more than 0.36 Btu/sq. ft. x h x deg F.
b. Operable Windows: Not more than 0.46 Btu/sq. ft. x h x deg F.

2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:

a. Fixed Windows: Not more than 0.25.
b. Operable Windows: Not more than 0.22 determined in accordance with NFRC 200.

3. Visible Transmittance (VT):

a. Fixed Windows: Not less than 0.42.
b. Operable Windows: Not less than 0.32.

4. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of not less than 56 for the frame and 64 for the glass.

D. Thermal Movements: Provide aluminum windows, including anchorage, which 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 joint sealants, 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: 120 deg F ambient; 180 deg F material surfaces.

E. Sustainable Design Features:

1. Adhesives: Do not use adhesives that contain urea formaldehyde.
2. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.3 ALUMINUM WINDOWS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arcadia, Inc.
2. EFCO Corporation
3. Kawneer Company, Inc.; Arconic Corporation
4. Or Approved Equal.

B. Basis of Design: Arcadia C3550 single hung window. For salient characteristics, refer to section 2.2.

C. Provide manufacturer's standard aluminum window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.

D. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Single hung.
2. Fixed.

E. Frames and Sashes: Aluminum extrusions of alloy, temper, and strength complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Broken Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

F. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

1. Note: Window units must comply with 2021 CECC requirements for U-values and

must be coordinated with the glass provided, as noted in Section 08 80 00 "Glazing."

G. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As indicated by manufacturer's designations.

H. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
3. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

I. Weather Stripping: Provide manufacturer's standard full-perimeter weather stripping for each operable sash unless otherwise indicated.

J. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Nail Fins: Manufacturer's standard mounting flanges with holes pre-punched for mechanical fasteners.

C. Insect Screens at Openings: Stainless steel, 16x16 mesh. Charcoal finish.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500 "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, air and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall

flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain water passing joints and condensation to the exterior.

D. Separate aluminum from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

3.4 CLEANING AND PROTECTION

A. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Avoid damaging finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 51 13

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
   a. "Flush Wood Doors"
   b. "Aluminum Framed Entrances and Storefronts"
   c. "Fiberglass Reinforced Plastic Doors"
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature

4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. All Hardware is intended to be 316 Stainless Steel, including pins, fasteners, nuts washers and related components.
   c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for VerificationNPS Project Manager:, Submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier. Units that are acceptable to NPS Project Manager may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Name and manufacturer of each item.
      4) Fastenings and other pertinent information.
      5) Location of each hardware set cross-referenced to indications on Drawings.
      6) Explanation of all abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for hardware.
      8) Door and frame sizes and materials.
      9) Degree of door swing and handing.
      10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
   b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Final approved hardware schedule edited to reflect conditions as installed.
   d. Final keying schedule
   e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
   f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
   a. Fire door assemblies, in compliance with NFPA 80.
   b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   a. For door hardware: DHI certified AHC or DHC.
   b. Can provide installation and technical data to NPS Project Manager and other related subcontractors.
   c. Can inspect and verify components are in working order upon completion of installation.
   d. Capable of producing wiring diagram and coordinating installation of electrified hardware with NPS Project Manager and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
    a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
    b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:
    a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
    b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware
    a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:
    a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
    a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
        1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
        2) Preliminary key system schematic diagram.
        3) Requirements for key control system.
        4) Requirements for access control.
        5) Address for delivery of keys.

2. Pre-installation Conference
    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.
    f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
    a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    a. Mechanical Warranty
        1) Locks
            a) Accurate 9100 Series: 1 years
        2) Closers

a) LCN 4000 Series: 30 years

b. Electrical Warranty
   1) Locks
      a) Schlage: 1 year

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."

   1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.

B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.

C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to NPS Project Manager's approval.

2.02 MATERIALS

A. Fabrication

   1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
   2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.

3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the NPS Project Manager where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Ives 5BB series

2. Acceptable Manufacturers and Products:
   a. Per NPS Project Manager's approval

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight, 316 Stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, 316 Stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:
   a. Exterior: Heavy weight, 316 Stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: 316 Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Per NPS Project Manager's approval

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Accurate 9100 series with marine grade finish/material

2. Acceptable Manufacturers and Products:
   a. Per NPS Project Manager's approval

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Provide mortise locks with bodies, strikes, faceplates, levers, and roses in marine grade material/finish.
3. Provide locks manufactured from heavy gauge marine grade 316 Stainless steel for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw 316 Stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of 316 Stainless steel.
6. Provide standard ASA 316 Stainless steel strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
7. Provide motor based electrified locksets that comply with the following requirements:
    a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
    b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
    c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
    d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
    e. Connections – provide quick-connect Molex system standard.

8. Lever Trim: Solid brass, bronze, or 316 Stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece 316 Stainless steel spindles.
    a. Lever Design: Accurate 39L.

2.06 DEADBOLTS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
    a. Schlage B600 Series

2. Acceptable Manufacturers and Products:
    a. Per NPS Project Manager's approval

B. Requirements:

1. Provide grade 1 deadbolt series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1-inch (25 mm) throw, constructed of steel alloy.
4. Provide manufacturer's standard strike.

2.07 ELECTRONIC ACCESS CONTROL LOCKSETS AND EXIT DEVICE TRIM

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Schlage CO Series

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:

1. Provide offline electronic access control products that comply with the following requirements:
   a. Listed, UL 294 - The Standard of Safety for Access Control System Units.
   b. Compliant with ANSI/BHMA A156.25 Grade 1 Operation and Security.
   c. Certified to UL10C, FCC Part15, Florida Building Code Standards TAS 201 large missile impact, TAS 202 and TAS 203.
   d. Compliant with ASTM E330 for door assemblies.
   e. Compliant with ICC / ANSI A117.1, NFPA 101, NFPA 80, and Industry Canada RSS-210.

2. Functions: Provide functions as scheduled that are field configurable without taking the offline electronic product off the door.
3. Emergency Override: Provide mechanical key override; cylinders: Refer to "KEYING" article, herein.
4. Levers:
   a. Vandal Resistance: Exterior (secure side) lever rotates freely while door remains locked, preventing damage to internal lock components from vandalism by excessive force.
   b. Provide pressure cast zinc plated, non-handed lever trim that operates independently of non-locking levers.
   c. Style: Schlage Sparta.

5. Power Supply: 4 AA batteries
   a. Provide electronic access control locks and/or exit device trim with the ability to communicate battery status.

6. Features:
   a. Visual tri-colored LED indicators that indicate activation, operational systems status, system error conditions and low power conditions.
   b. Visual bi-colored LED indicator on interior that can indicate secured/unsecured status of device to occupants on interior.
   c. Audible feedback that can be enabled or disabled.
   d. Onboard processor with memory capacity of 2,000 event audit history, up to 16 time zones and up to 32 calendar events.
   e. Central verification time of less than 1 second
   f. Tamper-Resistant Screws: Tamper torx screws on inside escutcheon for increased security.

7. Access:
   a. Programmable Keypad

1) 3-6-digit PIN code and 12 backlit buttons in a 3 x 4 matrix.
b. Magnetic Stripe
1) Reader: triple track (1, 2, or 3) and field configurable
c. Proximity
1) 125kHz frequency with a read range up to 1.25 inches.
2) Compatible credentials: 125kHz clamshell/fob, ISO card, key fob, PVC disk
3) Compatible manufacturers: Schlage, ISONAS, HID, GE/CASI, AWID

8. Operation:
a. Provide electronic access control locks and/or exit device trim with the ability to be configured at door by handheld programming device the length of time device is unlocked upon access grant.
b. Provide electronic access control locks and/or exit device trim with the ability to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by handheld programming device.

9. Programming Means:

2.08 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
a. Schlage Everest 29 T for Estimating purpose only, obtain approval from Owner

2. Acceptable Manufacturers and Products:
a. Per NPS Project Manager's approval

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer’s series as indicated. Refer to “KEYING” article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
a. Patented Restricted: cylinder with permanent core with patented, restricted keyway for estimating purpose only

3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
4. Nickel silver bottom pins.

2.09 KEYING

A. Scheduled System:

1. New factory registered system:
a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
   a. Temporary Construction Cylinder Keying.
      1) Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
         a) Split Key or Lost Ball Construction Keying System.
         b) 3 construction control keys, and extractor tools or keys as required to void construction keying.
         c) 12 construction change (day) keys.
      2) Owner or Owner's Representative will void operation of temporary construction keys.

2. Permanent Keying:
   a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
      1) Master Keying system as directed by the Owner.
   b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   c. Provide keys with the following features:
      1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
      2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
      3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
   d. Identification:
      1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
      2) Identification stamping provisions must be approved by the NPS Project Manager and Owner.
      3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
      4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
      5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
   e. Quantity: Furnish in the following quantities.
      1) Master Keys: 6.
      2) Change (Day) Keys: 3 per cylinder/core that is keyed differently
      3) Key Blanks: Quantity as determined in the keying meeting.

2.10 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:
   a. As required

2.11 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 4040XP series

2. Acceptable Manufacturers and Products:
   a. Per NPS Project Manager's approval

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.12 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Per NPS Project Manager's approval

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.13 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Trimco
   b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.14 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Zero International

2. Acceptable Manufacturers:
   a. National Guard
   b. Pemko

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.15 FINISHES

A. FINISH: BHMA 630 (US32D); EXCEPT:

1. Keypad locks: BHMA 626
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Door Closers: Powder Coat to Match
4. Weatherstripping: Clear Anodized Aluminum
5. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by NPS Project Manager.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

K. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by NPS Project Manager.

L. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by NPS Project Manager.

N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

R. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

   1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
   2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 INSPECTION

A. Contractor will commence accessibility inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. With few if any exceptions, the interior and exterior hardware specified for this project is intended to be Marine Grade 316 Stainless Steel to withstand the harsh coastal environment.

C. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the NPS with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

D. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

E. Hardware Sets:

102664 OPT0350317 Version 3

Legend:
Link to catalog cut sheet
Electrified Opening

Hardware Group No. 01

For use on Door #(s):

03

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	MORTISE LOCK-OFFICE/ENTRY W/MARINE GRADE FINISH	9124M 39L/1R 32D		630	ACC
1	EA	SURFACE CLOSER	4040XP SCUSH SRI		689	LCN
1	EA	GASKETING	188SBK PSA (HEADER & JAMBS)		BK	ZER
1	SET	GASKETING	429 @ HEAD & JAMBS		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A - OR PER SILL DETAILS		A	ZER

Hardware Group No. 02

For use on Door #(s):

02

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	MORTISE LOCK-OFFICE/ENTRY W/MARINE GRADE FINISH	9124M 39L/1R 32D		630	ACC
1	EA	SURFACE CLOSER	4040XP SCUSH SRI		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA (HEADER & JAMBS)		BK	ZER
1	SET	GASKETING	429 @ HEAD & JAMBS		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A - OR PER SILL DETAILS		A	ZER

Hardware Group No. 03

For use on Door #(s):

06A 09B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP-SPA-P6 4B BATTERY OPERATED		626	SCE
1	EA	SURFACE CLOSER	4040XP SCUSH SRI		689	LCN
1	EA	GASKETING	188SBK PSA (HEADER & JAMBS)		BK	ZER
1	SET	GASKETING	429 @ HEAD & JAMBS		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A - OR PER SILL DETAILS		A	ZER

Hardware Group No. 04

For use on Door #(s):

09A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		630	IVE
1	EA	MORTISE LOCK-PASSAGE W/MARINE GRADE FINISH	9125M 39L/1R 32D		630	ACC
1	EA	SURFACE CLOSER	4040XP CUSH SRI		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA (HEADER & JAMBS)		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A - OR PER SILL DETAILS		A	ZER

Hardware Group No. 05

For use on Door #(s):

21

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		630	IVE
1	EA	MORTISE LOCK-PASSAGE W/MARINE GRADE FINISH	9125M 39L/1R 32D		630	ACC
1	EA	SURFACE CLOSER	4040XP SRI		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MAGNET	SEM7830 12V/24V/120V		689	LCN
1	EA	GASKETING	188SBK PSA (HEADER & JAMBS)		BK	ZER

CONNECT MAGNETIC DOOR HOLDER TO FIRE ALARM SYSTEM

OPERATION:
DOOR IS NORMALLY HELD OPEN WITH THE MAGNETIC DOOR HOLDER
DOOR IS CLOSED AND LATCHED UPON ACTIVATION OF FIRE ALARM SYSTEM, OR LOSS OF POWER TO THE MAGNETIC DOOR HOLDER

Hardware Group No. 06

For use on Door #(s):

11 12 12 13

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		630	IVE
1	EA	MORTISE LOCK-PRIVACY W/MARINE GRADE FINISH	9139M 39L/1R 32D 7200ER		630	ACC
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA (HEADER & JAMBS)		BK	ZER

Hardware Group No. 07

For use on Door #(s):

05 14

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		630	IVE
1	EA	MORTISE LOCK-PRIVACY W/MARINE GRADE FINISH	9139M 39L/1R 32D 7200ER		630	ACC
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	GASKETING	188SBK PSA (HEADER & JAMBS)		BK	ZER

Hardware Group No. 08

For use on Door #(s):

04

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		630	IVE
1	EA	MANUAL FLUSH BOLT	FB358		626	IVE
1	EA	SGL CYL DEADBOLT	B660P6		626	SCH
1	EA	FLUSH PULL	950		626	IVE
2	EA	OH STOP	90S		630	GLY
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 09

For use on Door #(s):

32

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	NOTE	ALL HARDWARE BY VENTILATION DOOR MANUFACTURER		

FOR HARDWARE SPECIFIED FOR THIS DOOR, SEE SECTION 08 31 13 “ACCESS DOORS AND FRAMES.”

Hardware Group No. 10

For use on Door #(s):

06B 06C

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	NOTE	ALL HARDWARE BY ROLLUP DOOR MANUFACTURER		

Hardware Group No. A01

For use on Door #(s):

31

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	MORTISE LOCK-OFFICE/ENTRY W/MARINE GRADE FINISH	9124M 39L/1R 32D		630	ACC
1	EA	SURFACE CLOSER	4040XP EDAW/62G SRI		689	LCN
1	EA	DROP PLATE AND ACCESSORIES	PROVIDE AS NECESSARY		689	
1	EA	FLOOR STOP	FS441		626	IVE
1	EA	WEATHERSTRIPPING	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
1	EA	THRESHOLD	BY ALUMINUM DOOR/FRAME MANUFACTURER.			

VERIFY DOOR HEIGHT
HARDWARE IS FOR STOREFRONT DOOR WITH WIDE STILE

Hardware Group No. C01

For use on Door #(s):

WALK-IN COOLER

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
	EA	NOTE	ALL HARDWARE BY COOLER DOOR MANUFACTURER		

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements:
1. Section 08 41 13 "Aluminum Framed Entrances and Storefronts."
2. Section 08 44 13 “Glazed Aluminum Curtain Walls.”

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. CBC: California Building Code.

E. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
1. Product Data: For sealants, indicating VOC content.

2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Glass Samples: For each type of; 12 inches square.
1. Insulating glass.
   a. Clear with low-e coating
   b. Clear without low-e coating
   c. Clear with low-e coating with acid etched on #3 surface
   d. Custom tinted glazing for Level 3 Tower Enclosure.
2. Sample verification.
   a. The Contracting Officer shall review physical samples and provide verification of each glazing sample prior to procurement by the contractor.
   b. Section of existing tinted glazing to be retained for comparison to submitted samples.
   c. For Level 3 Tower Enclosure windows, Contracting Officer shall confirm whether glazing shall custom match the existing tower glazing or be as clear as possible for high visibility (see 2.2F below).

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings and in Specifications.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Preconstruction adhesion and compatibility test report.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Product shall be an engineered glazing product designed by a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to comply with wind performance

requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
   1. Design Wind Pressures: As indicated on Drawings .
      a. Wind Design Data: As indicated on Drawings.
   2. Design Snow Loads: As indicated on Drawings.
   3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
   4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick .
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
   4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200.
   5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

F. Optical Performance Properties of Glazing in Curtain Wall at Level 3 Tower Enclosure:
   1. Reflective Solar Hear Gain Coefficient (RSHGC) shall be reduced to 0.87 to provide a clear appearance and full visibility to support lifeguard duties.
   2. Glazing at level 3 of the lifeguard tower shall have a VT of 1.0 to provide clear appearance and full visibility to support lifeguard duties.
   3. The contracting officer shall select whether this optical performance or the custom color to match existing shall take priority at time of submittal. If custom color to match existing is selected, this section cannot be fulfilled and therefore shall be assumed to be not required.

G. Optical Performance Properties of Glazing at Restrooms:
   1. Glazing in restroom windows shall be acid etched to provide privacy.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. NGA Publications: "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 6 mm .
   2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AGC Glass Company North America, Inc.
      b. Cardinal Glass Industries, Inc.
      c. Guardian Glass LLC.
      d. Pilkington North America; NSG Group.
      e. Vitro Architectural Glass.
      f. Or Approved Equal.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AGC Glass Company North America, Inc.
      b. Cardinal Glass Industries, Inc.
      c. Guardian Glass LLC.
      d. Pilkington North America; NSG Group.
      e. Vitro Architectural Glass.
      f. Or Approved Equal.

C. Low-E-Coated Vision Glass: ASTM C1376.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cardinal Glass Industries, Inc.
      b. Guardian Glass LLC.
      c. Pilkington North America; NSG Group.
      d. Saint-Gobain Glass Corp.

e. Vitro Architectural Glass.
f. Or Approved Equal.

D. Low-E-Coated Custom Tinted Glass: ASTM C1376.
1. At Tower Windows, Types K, L, M, N, P, glass shall be custom tinted to match the existing windows.
2. Tint shall account for any color shift due to Low-E-Coating in matching existing.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Cardinal Glass Industries, Inc.
b. Guardian Glass LLC.
c. Pilkington North America; NSG Group.
d. Saint-Gobain Glass Corp.
e. Vitro Architectural Glass.
f. Or Approved Equal.

E. Acid Etched Privacy Glass:.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Guardian Glass LLC, SatinDeco
b. Pilkington North America; NSG Group, Optifloat Opal
c. Saint-Gobain Glass Corp., Satinovo Matt
d. Vitro Architectural Glass, Pavia
e. Or Approved Equal.
2. Acid Etch on one side (interior side).
3. When assembled into insulating glass unit, acid etch shall be on #3 surface.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction provided it is a thermal barrier or is thermal broken .
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Saint-Gobain Glass Corp.
2) Technoform Glass Insulation North America.
3) Thermix; a brand of Ensinger USA.
4) Or Approved Equal.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

B. Insulating requirements per 2022 CEC Table 140.3-B Thermal Envelope Insulation Min Requirement
1. Curtainwall/Storefront Fenestration – U-0.41 Maximum
2. Operable Fenestration – U-0.46 Maximum
3. Entry Doors – U-0.45 Maximum

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they 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.
3. Verify sealant complies with the requirements of Section 01 57 19.11 "Indoor Air Quality Management."
4. Colors of Exposed Glazing Sealants: Basis of Design: Clear or to match adjacent metal; final selection provided from Contracting Officer from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. GE Construction Sealants; Momentive Performance Materials Inc.
   b. Pecora Corporation.
   c. Sika Corporation.
   d. The Dow Chemical Company.
   e. Tremco Incorporated.
   f. Or Approved Equal.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; 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; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by 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:

1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:
1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:
1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit 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.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
a. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, 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 systems.
3. Minimum required face and 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.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. 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.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.
   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.

G. 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 in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

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, then to jambs. Cover horizontal framing joints by applying tapes to jambs, 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 right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

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. Cut compression gaskets to 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. Installation with Drive-in Wedge Gaskets: 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 in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. 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 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. 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.
   1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces 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.

3.8 INSULATING GLASS SCHEDULE

A. Clear Insulating Glass Type (G-1) at Window Types C and E:
   1. Overall Unit Thickness: 1 inch.
   2. Minimum Thickness of Each Glass Lite: 6 mm.
   3. Outdoor Lite: Annealed float glass.
   4. Interspace Content: Air.
   5. Indoor Lite: Annealed float glass.

B. Low-E-Coated, Clear Insulating Glass Type (G-2) at Window Types B, D, G, H, J:
   1. Overall Unit Thickness: 1 inch.
   2. Minimum Thickness of Each Glass Lite: 6 mm.
   3. Outdoor Lite: Annealed float glass.
   4. Interspace Content: Air.
   5. Indoor Lite: Annealed float glass.
   6. Low-E Coating: Sputtered on second surface.

C. Low-E-Coated, Clear Insulating Safety Glass Type (G-3) at Storefront Door 31(N) and Window Types M and P:
   1. Overall Unit Thickness: 1 inch.
   2. Minimum Thickness of Each Glass Lite: 6mm.
   3. Outdoor Lite: Fully Tempered Float Glass.
   4. Interspace Content: Air.
   5. Indoor Lite: Fully Tempered Float Glass.
   6. Low-E Coating: Sputtered on second surface.

7. Safety glazing required.

D. Low-E-Coated, Acid Etched Insulating Glass Type (G-4) at Window Type F:
   1. Overall Unit Thickness: 1 inch.
   2. Minimum Thickness of Each Glass Lite: 6 mm.
   3. Outdoor Lite: Annealed float glass.
   4. Interspace Content: Air.
   5. Indoor Lite: Annealed float glass.
   6. Low-E Coating: Sputtered on second surface, retained for color match with other windows.
   7. Acid Etching: On third surface.

END OF SECTION 08 80 00

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

a. Type X at rated assemblies
b. Mold-Resistant at Kitchen 102, Shower Rooms, and Restrooms.

2. Exterior gypsum board for ceilings and soffits.
3. Accessories: Soffit vents

B. Related Requirements:

1. Section 05 12 00 "Structural Steel" for steel structure.
2. Section 06 10 00 "Rough Carpentry" for framing.
3. Section 07 92 00 "Joint Sealants" for acoustical joint sealants.
4. Section 09 65 43 "Linoleum Flooring" for rubber base.
5. Section 09 91 23 "Interior Painting" for gyp finish.
6. Section 10 26 00 "Wall and Door Protection" for PVC paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Mold-resistant gypsum board.
4. Exterior gypsum soffit board.
5. Interior trim.
6. Exterior trim.
7. Acoustical sealant.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, and attachments to other work.

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

D. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, indicating VOC content.

2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For ceiling and wall materials, indicating compliance with requirements for low-emitting materials.

1.3 MOCKUPS

A. Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

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

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements and explicit approval of the Contracting Officer, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

B. Ceiling and wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

A. Regional Materials: Products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

B. Size: Provide 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. Gypsum Wallboard: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum
b. Armstrong Ceiling & Wall Solutions
c. CertainTeed; SAINT-GOBAIN
d. Georgia-Pacific Gypsum LLC
e. Gold Bond Building Products, LLC provided by National Gypsum Company
f. PABCO Gypsum
g. USG Corporation
h. Or Approved Equal

2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum

b. CertainTeed; SAINT-GOBAIN
c. Georgia-Pacific Gypsum LLC
d. Gold Bond Building Products, LLC provided by National Gypsum Company
e. PABCO Gypsum
f. USG Corporation
g. Or Approved Equal

2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum
b. CertainTeed; SAINT-GOBAIN
c. Georgia-Pacific Gypsum LLC
d. Gold Bond Building Products, LLC provided by National Gypsum Company
e. PABCO Gypsum
f. USG Corporation
g. Or Approved Equal

2. Core: As indicated on Drawings.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C1396/C1396M, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum
b. CertainTeed; SAINT-GOBAIN
c. Georgia-Pacific Gypsum LLC
d. Gold Bond Building Products, LLC provided by National Gypsum Company
e. PABCO Gypsum
f. Or Approved Equal

2. Core: 5/8 inch, Type X.

2.5 ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    e. Expansion (control) joint.

B. Soffit Vent

1. Size: 4 inch diameter round
2. Material: 316 stainless steel (not 304 stainless steel)
3. 45 degree louvers
4. Insect screen

    a. If product does not come with an insect screen (the boat vents reviewed during design did not), Contractor shall install separate insect screen into vent prior to installation in the soffit.
    b. Material: Stainless steel
    c. Mesh Size: 16 x 16 mesh

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

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

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Acoustical Sealant: As specified in Section 07 92 00 "Joint Sealants."

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support

framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

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 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

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. 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.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: At typical wall assemblies.
2. Type X: At fire rated wall assemblies.
3. Ceiling Type: At ceilings and soffits.
4. Mold-Resistant Type: At Kitchen 102, Shower Rooms, and Restrooms.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 FINISHING OF 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 for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 3: Panels that are substrate for PVC panels.
3. Level 4: At all gypsum board surfaces to receive paint.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

3.5 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

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SECTION 09 51 13- ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Acoustical ceiling panels.

B. Exposed grid suspension system.

C. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.

1.2 RELATED SECTIONS

A. Section 09 21 16 - Gypsum Board Assemblies

B. Division 15 Sections - Mechanical Work

C. Division 16 Sections - Electrical Work

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
   7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   8. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
   9. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.
   10. ASTM E 1264 Classification for Acoustical Ceiling Products.
   11. ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
   12. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
   13. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

C. Shop Drawings: Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with or supported by the ceilings.

D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

E. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the Contracting Officer's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
   1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
      a. Flame Spread: 25 or less
      b. Smoke Developed: 50 or less

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.7 PROJECT CONDITIONS

A. Space Enclosure:

All ceiling products and suspension systems must be installed and maintained in accordance with manufacturer's written installation instructions for that product in effect at the time of installation and best industry practice. Prior to installation, the ceiling product must be kept clean and dry, in an environment that is between 32°F (0°C) and 120°F (49°C) and not subject to Abnormal Conditions.
Abnormal conditions include exposure to chemical fumes, vibrations, moisture from conditions such as building leaks or condensation, excessive humidity, or excessive dirt or dust buildup.

1.8 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
    1. Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.
    2. Grid System: Rusting and manufacturer's defects
    3. Acoustical Panels designated as inherently resistive to the growth of micro-organisms installed with suspension systems: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

B. Warranty Period:
    1. Acoustical panels: Ten (10) years from date of substantial completion.
    2. Grid: Ten (10) years from date of substantial completion.

C. The Warranty shall not deprive the Government of other rights the Government may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

A. Extra Materials: Deliver extra materials to Contracting Officer. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
    1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.
    2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2-PRODUCTS

2.1 MANUFACTURERS

A. Ceiling Panels:

1. Armstrong World Industries, Inc.

2. Celotex Building Products Division.
3. USG Interiors, Inc.
4. Or Approved Equal.

2.2 ACOUSTICAL CEILING UNITS

A. Acoustical Panels Type ACT-1:

1. Surface Texture: Smooth
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24in X 24in X 5/8in
5. Edge Profile: Square Lay-In for interface with Prelude XL 15/16" Exposed Tee.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, N/A.
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, 33
8. Flame Spread: ASTM E 1264; Class A (UL)
9. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.89.
10. Antimicrobial Protection
11. Basis of Design: Kitchen Zone, 673 as manufactured by Armstrong World Industries.

2.3 SUSPENSION SYSTEMS

A. Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with 15/16 IN type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).
   1. Structural Classification: ASTM C 635 ID.
   2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
   3. Basis of Design: Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries, Inc.

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

E. Accessories

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
   1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

A. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

B. Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.

C. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

D. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

E. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 09 65 43 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Linoleum sheet flooring, identified as RF, “Resilient Flooring” on the drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For layout of linoleum flooring.
   1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

C. Samples for Selection Confirmation: For linoleum flooring and for rubber base.
   1. Samples shall be 2 x 2 inch segments of actual products, not simulated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials , from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of sheet flooring installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 90 deg F.
   1. Sheet Flooring: Store rolls upright.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive flooring during the following periods:
   1. 72 hours before installation.

2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient 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 flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Verify flooring products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 LINOLEUM SHEET FLOORING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong World Industries, Inc.
2. Forbo Flooring Systems (Basis of Design: Marmoleum).
3. Johnsonite; a Tarkett company.

B. Linoleum Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing .
1. Roll Size: In manufacturer's standard length, but not less than 78 inches wide.

C. Thickness: 0.10 inch .

D. Heat-Welding Bead: For seamless installation, solid-strand product of linoleum flooring manufacturer.
1. Colors: Match flooring color.

E. Basis of Design Color: Forbo Silt, to be confirmed through submittal process by Contracting Officer from manufacturer’s standard selection.

2.3 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.
1. Verify adhesives have a VOC content compliant with Section 01 57 19.11 "Indoor Air Quality" .
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 ACCESSORIES

A. Thermoset Rubber Base
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johnsonite; a Tarkett company.
      b. Roppe Corporation; Roppe Holding Company
      c. Or Approved Equal.
   2. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
   3. Style and Location:
      a. Style B, Cove: Provide in interior areas with linoleum flooring and sealed concrete flooring. See also Finish Schedule on Drawings.
   4. Thickness: 0.125 inch.
   5. Height: 6 inches.
   6. Lengths: Coils in manufacturer's standard length.
   7. Inside Corners: Job formed or preformed
   8. Basis of Design Color: Roppe Burnt Umber, to be confirmed through submittal process by Contracting Officer from manufacturer’s standard selection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by adhesive manufacturer. .
   4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Confirm moisture vapor emissions and internal relative humidity meet the limits stated by the manufacturer of the flooring and adhesive.

b. If none given by manufacturer: Concrete moisture vapor emissions must not exceed 8.0 lbs. per 1,000 square feet in 24hours and concrete internal relative humidity must not exceed 85% during installation.

C. Do not install flooring until materials are the same temperature as space where they are to be installed.
1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, thresholds, door frames, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Install flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

F. Adhere flooring to 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.

G. Heat-Welded Seams: For seamless installation, comply with ASTM F 1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 LINOLEUM SHEET FLOORING INSTALLATION

A. Unroll linoleum sheet flooring and allow it to stabilize before cutting and fitting.

B. Lay out linoleum sheet flooring as follows:
1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.
5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:
   1. Remove adhesive and other blemishes from surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 09 65 43

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SECTION 09 67 23 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resinous flooring identified as EPX, Epoxy Flooring, on the drawings.
2. Resinous flooring manufacturer's integral cove base accessories.
3. All items in this section are Bid Option D

B. Related Sections:

1. Section 03 30 00 "Cast in Place Concrete" for floor substrate.
2. Section 09 29 00 "Gypsum Board Assemblies" for wall substrate.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
2. Review details of integral cove bases.
3. Review manufacturer's written instructions for installing resinous flooring systems.
4. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.
2. Laboratory Test Reports: For finish system, indicating compliance with requirements for low-emitting materials.
3. Product Data: For adhesives, indicating that product contains no urea formaldehyde.

C. Samples for Initial Selection: For each type of exposed finish required.

D. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 6 inches square, applied to a rigid backing by Installer for this

Project.

E. Moisture test results of substrates (concrete and gyp board wall) to show compliance with manufacturer's requirements for installation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
2. Furnish proof that the Contractor and resinous flooring installer foreman have at least 5 years of experience in installation on projects of similar size and character along with three references from persons who were responsible for supervision of these projects. Include name, address, and telephone number of references who will testify to a successful completion of these projects by the Contractor and resinous flooring installer foreman.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Apply full-thickness mockups on 96-inch- square floor area selected by Contracting Officer.

a. Include 96-inch length of integral cove base with inside corner.

2. Simulate finished lighting conditions for Contracting Officer's review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with

other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Flammability: Self-extinguishing in accordance with ASTM D635.

2.2 RESINOUS FLOORING

A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arizona Polymer Flooring, Inc
b. Cornerstone Flooring
c. Crown Polymers Corp.
d. Dudick Inc.
e. Duraflex, Inc.
f. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
g. Everlast Epoxy Systems, Inc.
h. FLEXMAR Coatings, Inc.
i. Garland Company, Inc. (The)
j. Key Resin Company
k. Laticrete International, Inc.
l. Master Builders Solutions; brand of MBCC Group
m. Milamar Coatings, LLC
n. Sherwin-Williams High Performance Flooring
o. Sika Corporation; Flooring

p. Stonhard, Inc.
q. Tennant Coatings
r. Tnemec Company, Inc.
s. Or Approved Equal

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

C. System Characteristics:

1. Color and Pattern: As selected by Contracting Officer from manufacturer's full range.
2. Recycled Content - product shall use recycled content (recycled glass bottles, copper slag, or crushed porcelain chips) in place of the marble chips.
3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: 1/8 inch.

D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:

1. Compressive Strength: 10,500 psi minimum in accordance with ASTM C579.
2. Tensile Strength: 3,700 psi minimum in accordance with ASTM C307.
3. Coefficient of Friction: 0.6 min. in accordance with ASTM 326.3.
4. Abrasion Resistance: 4 mg maximum weight loss in accordance with ASTM D4060.
5. Hardness: 80 min., Shore D in accordance with ASTM D2240.

2.3 INTEGRAL COVE BASE ACCESSORIES

A. Installation Adhesive: As recommended in writing by accessory manufacturer.

1. Adhesives: Do not use adhesives that contain urea formaldehyde.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resinous flooring systems.

2. Verify the moisture content of the substrates meet manufacturer's requirements for installation. Submit results to Contracting Officer for review prior to installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than 6 or more than 8 pH unless otherwise recommended in writing by flooring manufacturer,

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.

1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.

C. Integral Cove Base Accessories: Adhesively install precast accessories before applying flooring coats and in accordance with manufacturer's written instructions.

D. Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring coats. Apply in accordance with manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 4 inches high.

E. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.

F. Grout Coat: Apply grout coat to fill voids in surface of final body coat.

G. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior Finish coatings.

a. Painting of Exterior Wood Trim
b. Painting of Exterior Gypsum Board Soffits

B. Related Requirements:

1. Section 06 20 13 "Exterior Finish Carpentry" for wood trim to be painted.
2. Section 09 29 00 "Gypsum Board" for exterior gypsum board to be painted.
3. Section 09 91 23 "Interior Painting" for interior finishes on wood, gypsum, and metal substrates.
4. Section 099300 "Staining and Transparent Finishing" for surface preparation and application of wood stains and transparent finishes on exterior wood substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product Schedule: Use same designations indicated on Drawings and in the exterior painting schedules to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. NPS Project Manager will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: NPS Project Manager will designate items or areas required.

2. 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 NPS Project Manager at no added cost to Government.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 FINISH COATINGS

A. Exterior Latex Paint, Semigloss: Water-based, pigmented emulsion coating formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Behr Paint Company; Behr Process Corporation
b. Benjamin Moore & Co.
c. Diamond Vogel Paint Company
d. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company)
e. Hempel (USA), Inc.
f. McCormick Paints
g. PPG Paints; PPG Industries, Inc.
h. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
i. Sherwin-Williams Company (The)
j. Valspar; a brand of The Sherwin-Williams Company
k. Or Approved Equal

2. Gloss Level: Manufacturer's standard semigloss finish.
3. Color, Basis of Design: White, Final color to be selected by NPS Project Manager from Manufacturer's standard color selection.

B. Exterior, Water-Based, Light Industrial Coating, Semigloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior wood surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Behr Paint Company; Behr Process Corporation
b. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company)
c. McCormick Paints
d. PPG Paints; PPG Industries, Inc.
e. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
f. Sherwin-Williams Company (The)
g. Valspar; a brand of The Sherwin-Williams Company
h. Or Approved Equal

2. Gloss Level: Manufacturer's standard semigloss finish.
3. Color, Basis of Design: White, Final color to be selected by NPS Project Manager from Manufacturer's standard color selection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Exterior Gypsum Board Substrates: Verify that finishing compound is dry and sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. Request prior approval in writing from NPS Project manager if removal is impractical or impossible because of size or weight of item, describe and apply approved surface-applied protection before surface preparation and painting.

1. After completing painting operations, only use workers skilled in the trades that originally installed items to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

D. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

2. Sand surfaces that will be exposed to view, and remove sanding dust.
3. Prime edges, ends, faces, undersides, cuts and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
4. Paint entire exposed surface of window and door trim.
5. Do not paint aluminum window frames and sashes. Do not paint FRP doors or frames.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by

NPS Project Manager, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE, WOOD SUBSTRATES

A. Dressed-Lumber Substrates: Trim.

1. Water-Based, Light Industrial Coating System :

a. Prime Coat: Exterior, alkyd/oil wood primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Exterior, water-based, light industrial coating, semigloss.

3.6 EXTERIOR PAINTING SCHEDULE, MISCELLANEOUS SUBSTRATES

A. Exterior Gypsum Board Substrates:

1. Latex System :

a. Prime Coat: Exterior, latex wood primer, reduced in accordance with manufacturer's written instructions for substrate and topcoat.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Exterior latex paint, semigloss.

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
    a. At galvanized steel to be painted with intumescent paint.
2. Water-based finish coating systems (including all layers).
    a. At gypsum wallboard walls and ceilings.
    b. At interior wood trim.
    c. At hollow metal door frames.
    d. As finish/protective topcoat for steel columns painted with intumescent paint.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for priming structural steel.
2. Section 08 12 13 "Hollow Metal Frames" for shop priming hollow metal door frames.
3. Section 09 29 00 "Gypsum Board Assemblies" for surface preparation of gypsum board walls and ceilings.
4. Section 09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
5. Section 09 96 46 "Intumescent Painting" for intumescent paint on third floor structural steel columns.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 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. NPS Project Manager will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
   b. Other Items: NPS Project Manager will designate items or areas required.

2. 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 NPS Project Manager at no added cost to Government.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless NPS Project Manager specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Paint Company; Behr Process Corporation
2. Benjamin Moore & Co.
3. Carboline Company; a subsidiary of RPM International
4. Conco Paints
5. Coronado Paint; Benjamin Moore & Co.
6. Diamond Vogel Paint Company
7. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company)
8. H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.
9. Hempel (USA), Inc.
10. Insl-X Products; Benjamin Moore & Co.
11. Kelly-Moore Paints
12. McCormick Paints
13. PPG Paints; PPG Industries, Inc.
14. Sherwin-Williams Company (The)
15. Valspar; a brand of The Sherwin-Williams Company
16. Or Approved Equal.

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

C. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

D. Emissions Requirements: Field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:

1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. VOC content shall not exceed limits of authorities having jurisdiction and the

following:

a. Flat Coatings: 50 g/L.
b. Nonflat Coatings: 100 g/L.
c. Primers, Sealers, and Undercoats: 100 g/L.

E. VOC Emissions: For field applications inside the building, wall paints shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

F. Colors: All colors to be confirmed with the NPS Project Manager during the submittal process.

1. Field Color: Sherwin Williams, Natural Linen
2. Where painted: ceiling color to be field color at 50% intensity.

2.2 PRIMERS

A. Water-Based Galvanized-Metal Primer: Corrosion-resistant, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Behr Paint Company; Behr Process Corporation
b. Benjamin Moore & Co.
c. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company)
d. Hempel (USA), Inc.
e. Kelly-Moore Paints
f. PPG Paints; PPG Industries, Inc.
g. Pratt & Lambert; a subsidiary of The Sherwin-Williams Company
h. Rodda Paint Co.
i. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
j. Sherwin-Williams Company (The)
k. Or Approved Equal

2.3 WATER-BASED FINISH COATS

A. Interior, Latex, Institutional Low-Odor/VOC, Gloss: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.

1. Gloss Level: Manufacturer's standard gloss finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Fiber-Cement Board: 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.
4. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean all welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces prior to applying finishes.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied one coat of primer and 2 coats of finish.

G. Aluminum Substrates: Remove loose surface oxidation.

H. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.

d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by NPS Project Manager.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by NPS Project Manager, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Water-based rust-inhibitive primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, semigloss.

B. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Water-based galvanized primer.
b. Intermediate Coat: Matching topcoat. Where specified in Section 09 96 46 "Intumescent Paint," intermediate coat is intumescent paint.
c. Topcoat: Interior, 2 finish coats latex, institutional low odor/VOC, semigloss.

C. Stainless Steel Substrates:

1. Water-Based Light-Industrial Coating System:

a. Prime Coat: Solvent-based bonding primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: 2 coats of Interior, water-based, light-industrial coating, semigloss.

D. Finish Carpentry: Wood trim.

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, gloss.

E. Fiberglass Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Water-based bonding primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, .

F. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, satin.

END OF SECTION 09 91 23

SECTION 09 93 00 - STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

1. Exterior Stain for Redwood Siding
2. Interior Stain and Sealer for Interior Wood Trim
3. Concrete Sealer on Garage Slab

1.02 RELATED REQUIREMENTS

A. Section 01 57 19.11 – Indoor Air Quality (IAQ) Management.

B. Section 09 91 23 - Interior Painting: Paint for gypsum board, wood trim, hollow metal door frames, structural steel.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; current edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.04 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category.
2. Manufacturer's installation instructions.

B. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, 9 by 9 inch (228.6 by 228.6 mm) in size.

C. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

D. Maintenance Materials: Furnish the following for Park's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Stain and Transparent Finish Materials: 1 gallon (4 L) of each color and type; from the same product run, store where directed.
3. Label each container with color and type in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years' experience and approved by manufacturer.

C. 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. NPS Project Manager will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. or 10 linear feet for trim.
   b. Other Items: NPS Project Manager will designate items or areas required.
2. 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 NPS Project Manager at no added cost to Government.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless NPS Project Manager specifically approves such deviations in writing.
4. Subject to approval of contractor's written request to NPS project Manager, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperature: 50 degrees F (10 degrees C) unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide finishes used in any individual system from the same manufacturer; no exceptions.

B. Approved Manufacturers:

1. Behr Process Corporation
2. Benjamin Moore
3. Sherman Williams
4. Valspar
5. Or Approved Equal.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:

1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each finish material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected by CO from the manufacturer's full line.

C. Colors: to be selected from the manufacturer's range of colors by NPS Project Manager.

2.03 EXTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood:

1. Stain: Exterior Solid Stain for Wood, Water Based; MPI #16. redwood siding

B. Acceptable Products:

1. Sherwin Williams ProMar 200 Exterior Solid Color Acrylic Latex Stain.
2. Benjamin Moore Ultra Spec Exterior Solid Color Stain
3. Or approved equal

C. Salient Characteristics:

1. Stain: Exterior Solid Stain for Wood, Water Based
2. Acrylic Latex
3. UV Resistance
4. Semi-Solid or Solid (to be selected by NPS Project Manager from manufacturer's standard selection)
5. Color: White or Light Grey (to be selected by NPS Project Manager from manufacturer's standard selection)

2.04 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood – Wood Trim:

1. Stain: Semi-Transparent Stain for Wood, Water Based; MPI #186.
   a. Products:
      1) Basis of Design: PPG Paints Deft Interior Water-Based Wood Stain, DFT300 Series. (MPI #186)
   b. Salient Characteristics:
      1) Waterborne Alkyd
      2) Semi-Transparent
      3) VOC: Less than 250 g/L
      4) Color: To be selected by NPS Project Manager from manufacturer's standard selection
2. Finish Sealer: Water-Based Polyurethane.
   a. Products:
      1) Basis of Design: PPG ProLuxe PLX257, Gloss
   b. Salient Characteristics:
      1) Water-based Polyurethane
      2) Clear
      3) VOC: Less than 275 g/L
      4) Sheen: Gloss, to be confirmed by NPS Project Manager from manufacturer's standard selection.

2.05 CONCRETE SEALER

A. Salient Characteristics: Clear, water-based, oil resistant, UV stable, chemical resistant, waterproof, polyurethane sealer.

5. Basis of Design: CoverTec Oil Resistant Concrete Sealer, U140
6. Other Approved Manufacturers: Subject to compliance with requirements above:
   a. ChemMasters, Inc.
   b. ChemTec International.

c. Concrete Sealers USA.
d. Curecrete Distribution Inc.
e. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
f. Kaufman Products, Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Master Builders Solutions; brand of MBCC Group.
j. NewLook International, Inc.
k. Nox-Crete Products Group.
l. Sika Corp.
m. Or Approved Equal

7. Verify products comply with the requirements of Section 01 57 19.11 "Indoor Air Quality Management" for VOC limits.

2.06 ACCESSORY MATERIALS

A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of stains and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Wood Doors: Seal all door tops, sides, faces, all mortised or bored surfaces for hardware & bottom edge surfaces with 1 coat primer and 2 coats finish of NPS approved products.

3.03 APPLICATION

Note- On all siding, soffit and exterior trim, stain is required to be applied on all sides; backs, faces and edges prior to installation. Apply additional product as required to cuts during installation for uniform weather protection. Use diligence and care to apply product in a fashion to maintain consistent finished appearance and increased resistance to the elements present in the coastal climate.

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual"

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

B. CO will provide field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 93 00

SECTION 09 93 00 - STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

1. Exterior Stain for Redwood Siding
2. Interior Stain and Sealer for Interior Wood Trim
3. Concrete Sealer on Garage Slab

1.02 RELATED REQUIREMENTS

A. Section 01 57 19.11 – Indoor Air Quality (IAQ) Management.

B. Section 09 91 23 - Interior Painting: Paint for gypsum board, wood trim, hollow metal door frames, structural steel.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; current edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.04 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category.
2. Manufacturer's installation instructions.

B. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, 9 by 9 inch (228.6 by 228.6 mm) in size.

C. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

D. Maintenance Materials: Furnish the following for Park's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Stain and Transparent Finish Materials: 1 gallon (4 L) of each color and type; from the same product run, store where directed.
3. Label each container with color and type in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years' experience and approved by manufacturer.

C. 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. Contracting Officer will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. or 10 linear feet for trim.
   b. Other Items: Contracting Officer will designate items or areas required.
2. 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 Contracting Officer at no added cost to Government.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperature: 50 degrees F (10 degrees C) unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide finishes used in any individual system from the same manufacturer; no exceptions.

B. Approved Manufacturers:

1. Behr Process Corporation
2. Benjamin Moore
3. Sherman Williams
4. Valspar
5. Or Approved Equal.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:

1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each finish material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected by CO from the manufacturer's full line.

C. Colors: to be selected from the manufacturer's range of colors by Contracting Officer.

2.03 EXTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood:

1. Stain: Exterior Solid Stain for Wood, Water Based; MPI #16. redwood siding

B. Acceptable Products:

1. Sherwin Williams ProMar 200 Exterior Solid Color Acrylic Latex Stain.
2. Benjamin Moore Ultra Spec Exterior Solid Color Stain
3. Or approved equal

C. Salient Characteristics:

1. Stain: Exterior Solid Stain for Wood, Water Based
2. Acrylic Latex
3. UV Resistance
4. Semi-Solid or Solid (to be selected by Contracting Officer from manufacturer's standard selection)
5. Color: White or Light Grey (to be selected by Contracting Officer from manufacturer's standard selection)

2.04 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood – Wood Trim:

1. Stain: Semi-Transparent Stain for Wood, Water Based; MPI #186.
   a. Products:
      1) Basis of Design: PPG Paints Deft Interior Water-Based Wood Stain, DFT300 Series. (MPI #186)
   b. Salient Characteristics:
      1) Waterborne Alkyd
      2) Semi-Transparent
      3) VOC: Less than 250 g/L
      4) Color: To be selected by Contracting Officer from manufacturer's standard selection
2. Finish Sealer: Water-Based Polyurethane.
   a. Products:
      1) Basis of Design: PPG ProLuxe PLX257, Gloss
   b. Salient Characteristics:
      1) Water-based Polyurethane
      2) Clear
      3) VOC: Less than 275 g/L
      4) Sheen: Gloss, to be confirmed by Contracting Officer from manufacturer's standard selection.

2.05 CONCRETE SEALER

A. Salient Characteristics: Clear, water-based, oil resistant, UV stable, chemical resistant, waterproof, polyurethane sealer.

5. Basis of Design: CoverTec Oil Resistant Concrete Sealer, U140
6. Other Approved Manufacturers: Subject to compliance with requirements above:
   a. ChemMasters, Inc.
   b. ChemTec International.
   c. Concrete Sealers USA.
   d. Curecrete Distribution Inc.
   e. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
   f. Kaufman Products, Inc.

g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Master Builders Solutions; brand of MBCC Group.
j. NewLook International, Inc.
k. Nox-Crete Products Group.
l. Sika Corp.
m. Or Approved Equal

7. Verify products comply with the requirements of Section 01 57 19.11 "Indoor Air Quality Management" for VOC limits.

2.06 ACCESSORY MATERIALS

A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of stains and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

B. CO will provide field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 93 00

SECTION 09 96 46 - INTUMESCENT PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Intumescent paint for interior items and surfaces.
2. Steel columns at Third Floor of Tower.

B. Related Requirements:

1. Section 05 12 00 "Structural Steel Framing" for steel substrate for intumescent paint finishes.
2. Section 09 91 23 "Interior Painting" for primers and finish coats that may be used with intumescent paint finishes.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Indicate VOC content.
2. Indicate approved substrates for product.
3. Indicate products' testing, certification, Fire Resistance Standards the product complies with.
4. Indicate application procedures, cleanup and safety, and maintenance.

B. Samples: For each type of topcoat product.

C. Product Schedule: Use same designations indicated on Drawings and in Part 3 intumescent painting schedules to cross-reference paint systems specified in this Section. Include color designations.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each intumescent paint.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match materials applied and that are packaged with

protective covering for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent of each color applied, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply waterborne intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 50 and 90 deg F.

B. Do not apply intumescent paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Allow wet surfaces to dry thoroughly and to attain temperature and conditions specified before starting or continuing coating operation.

PART 2 - PRODUCTS

2.1 INTUMESCENT PAINT PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Albi Protective Coatings
2. FireFree Coatings, Inc.
3. FlameOff Coatings, Inc.
4. Insl-X Products; Benjamin Moore & Co.
5. NoFire Technologies, Inc.
6. PPG Paints; PPG Industries, Inc.
7. Quantum Chemical High Performance Coatings; Quantum Technical Services Ltd.
8. Or Approved Equal

B. Basis of Design Product: FlameOFF Fire Barrier Paint

C. Comply with requirements for fire-retardant coating classification and surface-burning characteristics indicated.

D. Fire Resistant Rating: As tested according to ASTM E119 and UL 263 - One Hour Rated.

1. One hour rated.
2. One Hour Rated

E. Surface-Burning Characteristics of Fire-Retardant Systems: As tested according to ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.
3. Class A

F. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each material or coat, provide products recommended in writing by intumescent paint manufacturer for use on substrate indicated.
3. For galvanized steel substrate, provide a manufacturer approved primer as part of the system.

G. Material Emissions and Pollutant Control: Field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:

1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
2. VOC content shall not exceed limits of authorities having jurisdiction and the following:

a. Flat Coatings: 50 g/L.
b. Primers, Sealers, and Undercoaters: 100 g/L.

H. Colors and Gloss: Basis of Design, Standard Flat White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for surface treatments, shop-primed surfaces, maximum moisture content, and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions, and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected

and surfaces are dry.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and coating systems indicated.

B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if surface moisture content or alkalinity exceeds that permitted in manufacturer's written instructions.

1. Remove incompatible primers, and reprime substrate with compatible primers as required to produce coating systems indicated.
2. Perform cleaning and coating application so dust and other contaminants from cleaning process do not fall on wet, newly coated surfaces.

3.3 INSTALLATION

A. Apply intumescent paints according to manufacturer's written instructions and to comply with requirements for listing and labeling for surface-burning characteristics specified.

1. Use equipment and techniques best suited for substrate and type of material being applied.
2. Coat surfaces behind movable items the same as similar exposed surfaces.
3. Apply each coat separately according to manufacturer's written instructions.
4. Apply to thickness required to achieve specified rating per manufacturer's written instructions.

B. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

1. Pigmented Finishes: If undercoats or other conditions show through pigmented topcoat/overcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Contracting Officer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

END OF SECTION 09 96 46

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SECTION 10 14 23.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.3 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

D. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

E. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
2. Variable Component Materials: Full-size Sample of each base material, character

(letter, number, and graphic element) in each exposed color and finish not included in Samples above.

3. Exposed Accessories: Full-size Sample of each accessory type.
4. Full-size Samples, if approved, will be returned to Contractor for use in Project.

F. Product Schedule: For room-identification signs. Use same designations indicated on Drawings. Room designations shall be confirmed through the submittal process.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction, and, ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACE Sign Systems, Inc.
b. ASE, Inc
c. ASI Sign Systems, Inc
d. Best Sign Systems, Inc.

e. Clarke Systems
f. Mohawk Sign Systems
g. Poblocki Sign Company, LLC
h. Vista System, LLC
i. Vomar Products, Inc
j. Or Approved Equal

2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to phenolic backing sheet to produce composite sheet.

a. Composite-Sheet Thickness: 0.25 inch.
b. Color(s): As selected by Contracting Officer from manufacturer's full range.

3. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Square cut.
b. Corner Condition in Elevation: Square.

4. Mounting: Surface mounted to wall with countersunk flathead through fasteners.
5. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
b. Fastener Heads: Use oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
    b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings, and, according to the accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Contracting Officer.

3.3 INSPECTION

A. Contractor will commence accessibility inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

END OF SECTION 10 14 23.16

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SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Abuse-resistant wall coverings referred to in the drawings as “PVC Panel Smooth.”

B. Related Requirements:

1. Section 09 29 00 "Gypsum Board" for gyp substrate.
2. Section 09 91 23 "Interior Painting" for adjacent finish.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include elevations of all locations.

D. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1. Include samples of panels to allow selection of color with real material.

E. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Abuse-Resistant Wall Covering: 6 by 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of exposed plastic material.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Abuse Resistant Sheet Wall Covering: One additional panel of each color/texture installed.
2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store wall covering in a horizontal position.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-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 including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond

normal use.

b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities, and, ICC A117.1.

2.2 ABUSE-RESISTANT WALL COVERINGS

A. Abuse-Resistant Sheet Wall Covering: Fabricated from semirigid, plastic sheet wall-covering material.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuraMAX PVC Wall Panels or comparable product by one of the following:

a. Koroseal Interior Products, LLC
b. Nystrom, Inc.
c. Pawling Corporation
d. WallGuard.com
e. Or Approved Equal

2. Size: 16" wide x 48" tall.
3. Sheet Thickness: 0.5 inch.
4. Color and Texture: As selected by Contracting Officer from manufacturer's full range.
5. Height: As indicated.
6. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
7. Mounting: Adhesive.

2.3 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Fasteners: Nonmagnetic stainless-steel screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: As recommended by protection product manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.5 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

B. Examine walls to which wall and door 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.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall protection according to manufacturer's written instructions, 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.

B. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
3. Adjust end, and, top caps as required to ensure tight seams.

C. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

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SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Toilet Tissue (Roll) Dispenser
2. Recessed Trash Receptacle
3. Shower Curtain Rod
4. Soap Dish
5. Touch Free Soap Dispenser
6. Grab Bar
7. Mirror Unit
8. Under-lavatory Guard
9. Robe Hook

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

1. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

B. Maintenance Keys/Equipment: Keys and other accessories used for maintenance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Specialties, Inc.
   b. AJW Architectural Products.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. Or Approved Equal.
2. Basis of Design: Bobrick B-4288.
3. Description: Two roll, standard core, toilet tissue dispenser.
4. Mounting: Surface mounted.
5. Operation: Non-control delivery with standard spindle.
6. Capacity: Designed for 5-inch- diameter tissue rolls.
7. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Recessed Trash Disposal:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Specialties, Inc.
   b. AJW Architectural Products.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. Or Approved Equal.
2. Basis of Design: Bobrick, B-43644
3. Description: Semi-recessed stainless steel waste receptacle.
4. Mounting: Semi-recessed (protrudes from wall 5 inches from wall)
5. Minimum Capacity: 12.8 gal (48.3L).
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
7. Accessibility Notes:
   a. Bottom of receptacle shall be mounted less than 27” from the floor to ensure compliance with Limits of Protruding Objects section of both ABAAS and ANSI A117.1.
8. Locations: Only used in ABAAS compliant spaces to maintain floor clearances.

C. Shower Curtain Rod
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Specialties, Inc.
      b. AJW Architectural Products.
      c. Bobrick Washroom Equipment, Inc.
      d. Bradley Corporation.
      e. Or Approved Equal.
   2. Basis of Design: Bobrick B-6107
   3. Description: Heavy duty shower curtain rod.
   4. Material: 18-8, type 304 Stainless steel, satin finish.
   5. Mounting: Wall mounted
   6. Length: To match opening at shower, verify in field prior to purchase.

D. Soap Dish:
   1. Basis of Design: Bobrick, B-6807.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Specialties, Inc.
      b. AJW Architectural Products.
      c. Bobrick Washroom Equipment, Inc.
      d. Bradley Corporation.
      e. Or Approved Equal.
   3. Material: 18-8, type 304 Stainless steel, satin finish.
   4. Mounting: Wall mounted.
   5. Size: 4.25 inches by 3.375 inches.
   6. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

E. Touch Free Soap Dispenser:
   1. Basis of Design: GOJO, Purell ES8 Touch Free Soap Dispenser.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Uline.
      b. Tork.
      c. Bobrick Washroom Equipment, Inc.
      d. Or Approved Equal.
   3. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing soap in lather form.
   4. Mounting: Surface mounted.
   5. Capacity: 1,200 mL.
   6. Clear indicator when refills need to be changed.
   7. ABAAS compliant touch free activation.

F. Grab Bar:
   1. Basis of Design: Bobrick, B-9806.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Specialties, Inc.
      b. AJW Architectural Products.
      c. Bobrick Washroom Equipment, Inc.

d. Bradley Corporation.
e. Or Approved Equal.

3. Mounting: Flanges with concealed fasteners.
4. Material: Stainless steel, 0.05 inch thick, satin finish.
5. OD: 1-1/2 inches.
6. Configuration and Length: As indicated on Drawings.

G. Mirror Unit:
1. Basis of Design: Bobrick, B-290.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Specialties, Inc.
b. AJW Architectural Products.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. Or Approved Equal.
3. Frame: Stainless steel channel.
4. Corners: Manufacturer's standard.
5. Size: As indicated on Drawings.
6. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

H. Under-lavatory Guard
1. Manufacturer (Basis of Design): Plumberex Specialty Products, Trap Gear
2. ABAAS compliant.
3. Color: white or grey.
4. Model/part number to be coordinated with the p-trap and supply installation planned.
5. ASTM E 84-07: Class A, 25 Flame Spread/450 Smoke index.
6. Compliant with ASTM C 177
a. Thermal Conductivity 0.028 (K-value)
b. Thermal Resistance 0.504 (R-value)
7. Compliant with ASTM C 518
8. Thermal Conductivity 0.358 (K-value)
a. Thermal Resistance 0.346 (R-value)
b. Thermal Resistance 2.790 (R per inch)
9. Compliant with: ASTM G153, ASTM G21, ASTM D570, ASTM D412

I. Robe Hook:
1. Basis of Design: Bobrick, B-6717.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Specialties, Inc.
b. AJW Architectural Products.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. Or Approved Equal.
3. Material: 18-8, type 304 Stainless steel, satin finish.
4. Size: 2 inches by 2 inches.
5. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

2.2 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- minimum nominal thickness.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

D. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.3 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 to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with 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.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

3.3 INSPECTION

A. Contractor will commence accessibility inspection immediately after finishing work.

Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Semi-Recessed fire-protection cabinets for the following:

a. Portable fire extinguisher.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semi-recessed mounting method and relationships of box and trim to surrounding construction.

B. Product Schedule: For fire-protection cabinets. Confirm recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and

application.

2.2 FIRE-PROTECTION CABINET

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babcock-Davis
2. Croker; a Division of Morris Group International
3. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
4. Larsen's Manufacturing Company
5. Nystrom, Inc.
6. Or Approved Equal

B. Cabinet Construction: One-hour fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet and Cabinet Trim Material: Stainless steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Door Material: Stainless steel sheet.

F. Door Style: Solid opaque panel with frame.

G. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

H. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated on sheet A0.3.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Silk-screened or painted.
3) Lettering Color: Red.
4) Orientation: Vertical.

I. Materials:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.

a. Finish: ASTM A480/A480M No. 4 directional satin finish.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE-PROTECTION CABINETS

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:

1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
2. Fire-Rated Cabinets:

a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 50 30 – GEAR LOCKERS WALL MOUNTED

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall mounted gear lockers

1.2 REFERENCE

A. ASTM A513 – Minimum properties of Electric-Resistance-Welded Carbon Allow Steel Mechanical Tubing

B. ASTM A510 - Minimum properties of Wire Rods and Coarse Round Wire, Carbon Steel and Alloy Steel

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

B. Shop Drawings: Submit manufacturer's shop drawings for each individual run of lockers.

C. Samples: Submit manufacturer's standard color samples.

D. Owner's Manual: Provide maintenance manual at closeout.

E. Warranty: Submit manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of fifteen years experience in the direct manufacture of lockers.

B. Installer Qualifications: Installer shall have experience necessary to assure lockers are installed properly and according to manufacturer's instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers with labels identifying product and manufacturer's name.

B. Store materials in a clean dry area.

C. Protect materials and finish during installation and handling to prevent damage.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN MANUFACTURER

A. GearGrid Corporation, 670 SW 15th Street, Forest Lake, MN 55025. Toll-free 888-643-6694. Phone 651-464-4468. Fax 651-464-4780. Web site www.geargrid.com. Email sales@geargrid.com

B. Additional manufacturer's may be approved, however approval does not preclude the manufacturer from providing documentation supporting their product meets or exceeds all aspects of this specification section. Failure to provide proper documentation will result in the rejection of submitted product.

2.2 BASIS OF DESIGN PRODUCT

A. Lockers must be fabricated and manufactured in the U.S.A. Products not manufactured in the U.S.A will be rejected at the time of submittals.

B. Model: Standard Wall-Mount Locker by GearGrid

C. Size: 20" wide x 20" deep x 72" high

D. Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.

E. Vertical Dividers:
1. Outer Frames: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
2. Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
3. Inner Grid wires must be full length and width of inside vertical divider frame. Wires not running full length or width, thus creating exposed wire ends will not be acceptable.
4. Inner Grid wires must run horizontally and vertically creating a square or rectangular grid pattern only. Grid wires not creating a square or rectangular grid pattern will not be acceptable.
5. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.

F. Back Panel:
1. Required on each locker to protect the locker contents and wall substrate, as well as provide an additional panel for accessory attachment.
2. Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
3. Back panel must engage and be secured to vertical dividers via horizontal wires which extend into mounting holes pre-drilled in vertical dividers. Back panels are sandwiched between vertical dividers, preventing them from being removed after assembly is complete.
4. Inner Grid wires must be full length and width of inside vertical divider frame. Wires not running full length or width, thus creating exposed wire ends will not be acceptable.
5. Inner Grid wires must run horizontally and vertically creating a square or rectangular grid pattern only. Grid wires not creating a square or rectangular grid pattern will not be acceptable.

6. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.

G. Shelves:
1. (1) Upper, (1) Lower.
2. 0.25” diameter ASTM 510 cold drawn steel wire resistance welded and cold formed.

H. Apparel Hooks:
1. (3) per locker opening.
2. 0.192” diameter ASTM 510 cold drawn steel wire resistance welded, cold formed and powder coated.
3. Apparel hooks must securely engage and snap onto side or back grid, to prevent unintentional disengagement of hook.

2.3 ACCESSORIES

A. Door:
1. Frame: 1.25” O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
2. Inner Grid: .25” diameter ASTM 510 cold drawn steel wire resistance welded to a 3” square pattern.
3. Inner Grid wires must be full length and width of inside vertical divider frame. Wires not running full length or width, thus creating exposed wire ends will not be acceptable.
4. Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.
5. Top Cover:
   a. 0.25” diameter ASTM 510 cold drawn steel wire resistance welded to a 3” square pattern.
   b. To securely enclose the top of the locker.
   c. Top cover must engage and be secured to vertical dividers via horizontal wires which extend into mounting holes pre-drilled in vertical dividers.
   d. Top Covers are sandwiched between vertical dividers, preventing them from being removed after assembly is complete.
6. Hinge: Single pin welded style with brass pivot bushing. Door and Vertical Divider hinge components must be welded and not mechanically fastened.
7. Latch/Hasp: Self-latching with padlock hasp, constructed as follows;
   a. Vertical Divider side latch shall be minimum .125 in. sheet steel welded to Vertical Divider frame.
   b. Door side latch shall be constructed of .125 in. sheet steel and .1875 in. wire. Latch components manufactured from formed wire will not be acceptable.
   c. Constructed to accept typical padlock.

B. Hang Bar:
1. Hang Bars must be manufactured to allow each locker user to install at their desired height. Hang Bars that span multiple locker openings are not acceptable.
2. Tube: 1.25”O.D. x 16 gauge 304 stainless steel tubing.
3. Brackets: Allow Hang Bars to be securely attached to each vertical divider, powder coated.

C. Heavy Hanger:
1. 0.25” diameter 304 stainless steel wire cold formed and resistance welded.
2. Black vinyl coating on hook end.

2.4 FINISH

A. General: All system components excluding assembly and mounting hardware and stainless steel components are to receive the standard finish.

B. Standard Finish: Components to be cleaned using a phosphatized bath, clear water rinse and electro-statically coated with a durable and UV-stable TGIC powder coating process. Thickness of applied finish shall be 3 – 4 mm for added protection.
   1. Provide with Anti-Corrosive Primer.

C. Color: Black, Final color selection to confirmed from manufacturer's standard selection by Contracting Officer during submittal process.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive lockers.

B. Notify Contracting Officer if area are not acceptable.

C. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Install lockers in accordance with manufacturer's instructions.

B. Use manufacturer's hardware for assembly.

C. Anchor to mounting surface with proper hardware.

3.3 INSPECTION

A. Contractor will commence accessibility inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

END OF SECTION 10 50 30

SECTION 107313 – AWNINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bid Option E: Fixed shade sails.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for awnings.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, mounting heights, and attachment details.
2. Detail fabrication and assembly of awnings, including seam layout and spacing.
3. Show locations for blocking, reinforcement, and supplementary structural support.

C. Samples: For each exposed product and for each color and texture specified.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of fabrics and accessories involving color or finish selection.

E. Samples for Verification: For the following:

1. Awning Fabric: 12-inch (300-mm) square section of fabric from dye lot to be used for the Work, with specified treatments applied. Mark face of fabric.
2. Seam, Edge, and Corner Condition: Not less than 12-inch (300-mm) long section showing seam, edge, and corner treatment.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For awnings to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Fabricator: Acme Sunshades, 1548 West Winton Avenue, Hayward, CA, (510) 635-6383 or approved 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. Installer Qualifications: Fabricator of products.

1.7 WARRANTY

A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including framework.
    b. Deterioration of fabric including seam failure.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    d. Faulty operation of operator.

2. Awning Warranty Period: Three years from date of Substantial Completion.
3. Fabric Warranty Period: Three years from date of Substantial Completion.
4. Thread Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide awning fabrics with the fire-test-response characteristics indicated, as determined by testing identical products according to test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes California Code of Regulations, Title 19.
2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency for Flame-Spread Index of 25 or less.

3. Permanently attach label to each awning fabric indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals, and whether it requires retreatment after designated time period or cleaning.

2.2 FABRIC

A. Fabric: Polyfab Architec 400 or approved equal with the following characteristics:

1. Fiber Content: High Density Polyethylene
2. Weight: 12 oz. per square yard
3. Width: 12.5 feet.
4. Solar-Optical Properties: Ultra violet stabilizer
5. Openness Factor: 80 percent minimum.
6. UV-Light Blockage: 80 percent minimum.
7. Mildew Resistance: Showing no growth when tested according to ASTM G21.
8. Shrinkage: Not greater than 0.5 percent according to ASTM D1204.
9. Stretch Factor: Not less than 1 percent according to ASTM D4851.
10. Applied Treatment: Mildew resistant.
11. Pattern and Color: As selected by Contracting Officer from manufacturer's full range.

B. Seam Thread: 100 percent expanded PTFE, UV-light, mildew, and rot resistant.

C. Decorative Trims: Borders and bindings

1. Colors: Match awning fabric color

2.3 AWNING ACCESSORY MATERIALS

A. Grade 316 Stainless Steel:

1. Plates, Shapes, and Bars: ASTM A167/ASTM A240.
2. Tubing: ASTM A269

B. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, compatible, nonstaining materials. Provide as required for awning assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Contracting Officer from manufacturer's full range.

1. Wood Screws: ASME B18.6.1.
2. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
3. Grade 315 Stainless Steel Bolts, Nuts, Washers, D-Rings, Turnbuckles: ASTM F593-17
4. Grade 316 Stainless steel: Cable: ASTM A580

2.4 AWNING FABRIC FABRICATION

A. Fabrication: Reinforce wear points and hardware attachment points with webbing. Seam fabrics in locations indicated on the Drawings and as follows:

1. Fabric Edges, Hems and Seams: Manufacturer's standard hemming and seaming methods.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install awnings at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.

B. Install awnings after other finishing operations, including joint sealing and painting, have been completed.

C. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

D. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing awnings to structural support and for properly transferring load to in-place construction.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly, and lubricate as recommended by awning manufacturer.

3.4 CLEANING AND PROTECTION

A. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 107313

SECTION 11 00 00 - REQUIREMENTS FOR MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. KnoxBox
   2. Bid Option C: Hoist Equipment in Garage.

B. Related Requirements:
   1. Section 06 10 00 “Rough Carpentry” for blocking at wall mounted equipment.

1.2 SUBMITTALS

A. Product Data for all equipment.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For all equipment.

B. Sample Warranty: For all equipment.

PART 2 - PRODUCTS

2.1 ELECTRIC CHAIN HOIST

A. Basis of Design: Shopstar Electric Chain Hoist, No. 2109

B. Manufacturers:
   1. Columbus McKinnon (CM)
   2. Gorbel
   3. Tractel
   4. Uline
   5. Or Approved Equal

C. Type: Chain Hoist

D. Capacity: 1,000 lbs.

E. Lift: 10 feet

F. Lifting speed: 6 feet per minute

G. Motor: 1/6 HP

H. Reeving: Double

I. Dual Braking System – D.C. brake and regenerative brake

J. Electrical: 115V, Single Phase

K. Controller: Wired

L. Accessories:
1. All accessories to be by same manufacturer as hoist.
2. Swivel Hook
3. Universal Trolley
   a. Motorized
   b. Two-speed; 35/9 feet per minute
   c. Single phase

M. Color: Manufacturer's Standard.

N. Comply with NFPA 30.

2.2 KNOX BOX

A. Basis of Design: Knoxbox 3200, or Approved Equal

B. High security lock box for key storage for first responders and property management.

C. Size: Ability to store up to 10 keys.

D. Comply with UL 1037, UL 1610, UL 1332, UL 437

E. Exterior Grade; weather resistant components

F. Material:
1. Body: Heavy duty (1/4 inch min.) steel plate, stainless steel if available.
2. Door: 1/2 inch min. steel plate, stainless steel hinge.
3. Lock Dust Cover: 1/8 inch stainless steel plate dust cover with tamper seal mounting capability.

G. Lock: Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.

H. Color: To be selected by Contracting Officer from manufacturer's standard selection.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION

A. Confirm wall finish and floor finish are complete prior to installation to avoid finishing around equipment.

B. Confirm condition of mounting location and that blocking are acceptable to installer prior to installation. Installation of wall mounted equipment indicates acceptance of substrate.

3.2 INSTALLATION

A. Per manufacturer's written instructions.

END OF SECTION 11 05 13

SECTION 114000 – FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. All items in this section are part of Bid Option D.

B. This section includes the following:
   1. Item #2: Evaporator Coil, Cooler
   2. Item #3: Walk-In Cooler
   3. Item #4: Condensing Unit
   4. Item #21:Air Curtain, Unheated
   5. Item #43: Exhaust Hood
   6. Item #50: Fire Suppression System Manual Pull Box

1.02 DEFINITIONS

A. The following definitions are intended to clarify the relationships involved in this document and are used as a definition throughout this foodservice specification.
   1. Foodservice Equipment Contractor (F.E.C.): The F.E.C. is the party responsible for the supplying, delivering (including freight, staging and local warehousing as required), assembling, setting in place, installing, cleaning, sanitizing and/or the polishing of any foodservice item(s) included in this contract, but not limited to all required materials and labor, pursuant to the guidelines and time lines scheduled and/or rescheduled by the Contracting Officer.
   2. Sub-Contractors: The F.E.C. may contract Sub-Contractors to perform any portion of the contract, but the final responsibility for the proper performance of the contract rest solely with the F.E.C.
   3. General Contractor (Contractor): Has the responsibility for overall installation, scheduling, deliveries, coordination of various trades, rough-in and connection of utilities, including but not limited to all labor and materials for said rough-ins and connections for all equipment in this contract unless otherwise specified, by item, within the equipment data specification sections of this contract. The F.E.C. must coordinate his/her activities and needs with the Contractor in a timely manner as not to delay the project.
   4. The F.E.C. is the party responsible for all taxes, tariffs, duties and/or custom fees and permits where applicable, as may be required.
   5. N.I.F.C. - Whenever the abbreviation N.I.F.C. is used in this contract, it shall mean the item or items are not part of the Foodservice Equipment Contract.

1.03 INTERPRETATIONS

A. Plans and Specifications:
   1. Should it appear that the work intended to be described or any of the matters relative thereto are not sufficiently detailed or explained on the drawings or in the specifications, the Contractors shall apply to Contracting Officer for such drawings or explanations as may be necessary and shall conform to them as far as they shall be consistent with original drawings.

2. If any question arises regarding the true meaning of the drawings, specifications and/ typographical errors reference shall be made to Contracting Officer whose decision shall be conclusive.
3. In no instance shall a bid be submitted, or any work started with any uncertainty.
4. Before doing any work or ordering any materials, the Contractors shall verify all measurements of any work and shall be responsible for their correctness. Any differences which may be found shall be submitted to Contracting Officer for consideration before proceeding with the work.
5. Extra compensation will not be allowed because of differences between actual dimensions and measurements indicated on the working drawings.
6. Where a conflict occurs between or within standards, specifications, codes, ordinances and/or working drawings the more stringent or higher quality requirements shall apply.

B. Applicable Documents:
1. Bidding Documents, Contract Forms, and related materials issued by the Government before awarding a contract apply to this section.
2. Architectural, Mechanical, Electrical, and Structural Plans and other Specifications including all supplements issued thereto and other pertinent documents issued by the Government, are a part of these Specifications and the accompanying foodservice equipment plans and shall be complete within every respect. All the above included herewith, will be issued as part of the bid documents and shall not relieve the Contractors of responsibility or be used as a basis for additional compensation due to omission(s) of Architectural, Structural, Mechanical, Plumbing, or Electrical details from foodservice equipment documents.

C. Base Bids and Substitutions: Base bids shall be for furnishing all primary manufacturer, equipment and material as specified. Failure to furnish bids exactly as specified may disqualify bidder.
1. Bidders may request to quote on substitute products, which include additional listed manufacturers. Substitution requests must be supplemented by sufficient information in the form of manufacturer's technical specifications, drawings, pictures and/or samples to evaluate equality, appearance, and all other related conditions.
2. Written substitution requests must be submitted for approval or rejection, in accordance with the guide lines and time lines as set forth by in the Division 1 specifications. No substitutions will be considered after this time. Substitutions will not be allowed without prior written approval from the Contracting Officer.
3. All submittals for proposed substitutions must be submitted with an equipment data sheet for each item. The data sheet shall consist of the project name, the firm submitting, the item number, the manufacturer, the manufacturer's model number, a complete written description of what is to be provided, an accessories and options list of what is to be provided, finishes, dimensions, utility requirements as provided (ie: gas: natural or LP, electrical: voltage/phase and amps, plumbing/mechanical: water/sewer, etc.) as well as type of connection. The data sheet shall have a blank space (3-1/2-inches wide x 5-inches high) in the lower right corner of the sheet for stamping, etc. This information must be submitted not less than fifteen days from the bid due date to be considered as an alternate.
4. Where substitutions are made by the F.E.C. with the written approval of Contracting Officer, the F.E.C. shall be responsible for and pay all costs of any consequential modifications which may result from the substitution.

5. If the F.E.C. decides to submit an alternate manufacturer and receives a written response from Contracting Officer accepting this change, then all resulting expenses incurred in the changes or additions to the food service equipment work as well as other contractors work shall be the sole responsibility of the F.E.C. and shall be considered as part of the base bid with no additional compensation permitted.
6. The Manufacturer and model number of any article, device, material and/or form of construction listed in the "Itemized Specifications" as the "Primary Manufacturer" shall establish the "Basis of Design and Specification Standard", with respect to the physical dimensions, characteristics, aspects, capacities, performance and/or quantities required herein. If F.E.C. chooses to utilize one of the approved listed manufacturers, then they must provide submittal information to Contracting Officer for analysis and conclusive determination with respect to that item.
7. Accepted substitutions will be noted in an addendum issued by the PA/E. No other substitutions and/or deviations from the primary manufacturer will be permitted subsequent to the date of the Bid Opening, except by specific change order and only with sufficient cause. The approval of a substitution does not approve, relieve and/or change the Contractors responsibilities as outlined herein.

D. Intent:
1. It is the intent of the Contract Documents for each and every item and/or component to be complete with all required devices and standard features necessary for that item and/or component to properly function.
2. It is the intent of the Contract Documents for each and every item and/or component to function and perform in a manner equal to the Primary Manufacturer's intent. F.E.C. is required to notify Contracting Officer in writing of any or all discrepancies or omissions of any components prior to submitting bid.
3. Failure of the F.E.C. to report any discrepancies and/or omissions prior to submitting his bid shall not relieve the F.E.C. of his responsibilities for providing complete, functioning, workable systems in full accordance with the intent of the Contract Documents.

E. Responsibility Matrix:
1. The following represents the basic contractor responsibilities for this project.
2. Abbreviations:
   a. CM - Construction Manager
   b. GC - General Contractor
   c. FEC – Foodservice Equipment Contractor
   d. PC- Plumbing Contractor
   e. EC - Electrical Contractor
   f. MC - Mechanical Contractor
   g. MWC - Millwork Contractor

Task	Responsibility
3. Project Coordination	Contractor
4. Permits (Health Department)	Government/Concessioner
5. Construction Schedule	Contractor
6. Coordination of Inspections (Foodservice)	FEC
7. Wall Repairs (If Required)	Contractor
8. Rough-In Drawings	FEC
9. Rough-Ins (Required Service to Utility Connections Noted on FEC Rough-In Drawings)	PC/EC/MC

10.	PVC Wall Panels	Contractor
11.	Furnish of Specified Equipment	FEC
12.	Indirect Wastes Extend From Equipment to Drains	PC
13.	Installation of Foodservice Equipment	FEC
14.	Final Utility Connection	PC/EC/MC
15.	Utility Interconnections	PC/EC/MC
16.	Trim and Seal Foodservice Equipment	FEC
17.	Clean-Up of Foodservice Areas	FEC
18.	Walk-In Refrigeration Floor Insulation	FEC
19.	Walk-In Refrigeration Sub-Floor and Finished Floor	Contractor
20.	Walk-In Refrigeration Lighting	FEC Furnished, EC Installed
21.	Ceilings	Contractor
22.	Floor Troughs	FEC Furnished, PC Installed
23.	Floor Sinks, Floor Drains, Funnel Floor Drains	PC
24.	Mop Sinks, Hand Sinks	PC
25.	Insulation of Piping	PC

1.02 SCOPE

A. Work Included:

1. Work required under this section consists of providing all necessary services, tools, equipment, material and labor required to provide the continuous installation (the term installation shall mean the complete installation including, but not limited to, the delivery of all food service equipment items and necessary components complete with transportation charges and taxes prepaid by the F.E.C. to the job site's location) as designated on the food service equipment plan, uncrated, erected, set in place, leveled and made ready for final connection, by Contractor, to plumbing, gas, electrical and/or steam utilities and properly anchored and/or trimmed as may be required.
2. F.E.C. is to deliver all parts and/or components, which are to be built into cast-in-place concrete and/or masonry in ample time for inclusion in the concrete and/or masonry work. Furnish necessary setting plans and/or instructions, oversee the installation of all parts in the masonry and/or concrete and be responsible for the correctness and accuracy of the location and installation.
3. F.E.C. to provide holes, ferrules and/or stainless-steel chases on equipment for pipes, drains, electrical outlets, conduits, and similar items as may be required to coordinated and accommodate the installation of the food service equipment in connection with the work of other contractors.
4. F.E.C. to provide the necessary materials, labor, services, and incidentals necessary for the completion of these sections of work including but not limited to adhesive, caulking, sealing, trim strips, chases, corner guards, corner trims and/or closure panels.
5. F.E.C. to provide items and components hereinafter specified and/or shown on plans, completely assembled, or erected in locations indicated, ready for final connections to service, by the respective trades. The labor and material(s) required for final connections are the responsibility of Contractor
6. F.E.C. to provide and install where required fasteners, flashing, trim strips, filler panels, cant strips and caulking and/or sealant required to complete the installation.
7. All roof, wall and/or floor assemblies including finishes (as specified herein), penetrations, openings, curbs, platforms and/or dunnage pursuant to the requirements of the food service

ventilation and/or refrigeration items are to be provide and installed by the Contractor unless specified otherwise.

8. Keep premises clean and remove from the site all crates, cartons and other debris resulting from the work. Leave all areas "broom cleaned" and all equipment items and furnishings "construction clean". Final cleaning, sanitizing and polish of all equipment items and furnishings shall be done by the F.E.C. Further, it is the F.E.C.'s responsibility to provide protective coverings for all equipment items delivered to the job site during construction.

B. Related Work of Other Contractors:

1. General Construction by Contractor:
   a. All floor assemblies including finishes, openings, depressions, sleeves, curbs and bases.
   b. All wall and/or partition assemblies including finishes, openings, recesses, sleeves, furring and backing.
   c. All ceiling assemblies including finishes, openings, soffits, access panels, fire separation and sleeves.
   d. All roof assemblies including finishes, openings, curbs, platforms, and dunnage.
   e. All structural supports or grounds for hanging or fastening of food service equipment assemblies as may be described in this section.
   f. Contractor to provide on-site storage trailer(s) and security for F.E.C. provided food service equipment to be used on this project, if applicable.

2. Plumbing by Contractor:
   a. Water, gas and steam supply systems, as required.
   b. Sanitary and grease laden drainage systems.
   c. Final plumbing connections including mounting of drains, faucets, pre-rinses, hoses, and piping from point of connection on equipment to building plumbing systems and interconnections between equipment components. Install all hoses from utility raceways to connection points on equipment.
   d. Grease traps.
   e. Indirect drain line runs from equipment items to nearest floor drain or floor sink as required.
   f. Gas, water, and steam pressure reducing valves and all other fittings as required.
   g. Gas shut off valve(s) as required for ventilator fire suppression system and gas regulators on individual pieces of gas fired equipment in accordance with the manufacturer's recommendations are to be provided by the F.E.C. and installed by the Contractor.
   h. F.E.C. to furnish faucets with nipples, elbows, supply lines and valve stops, drains and/or splash mounted vacuum breakers, etc. for each equipment item as specified herein. Items to be installed by the Contractor.
   i. All exposed plumbing related to or in connection with food service items to be chrome plated.
   j. Indirect wastes shall be chrome plated and are to drip over and into floor drains. Where drains and/or supply lines run under equipment provide the proper support from the underside of the equipment to eliminate interference with cleaning and/or maintenance.
   k. When the Exhaust Hood Systems are to be furnished and installed by Division 15 and are not to be included as part of the F.E.C. work, Division 15 shall provide and install

the gas valve in the main supply line serving the cooking equipment to shut-off gas service to the cooking equipment in the event of fire system actuation. This work must be coordinated with the F.E.C. and in accordance with NFPA 17A, and NEC. This work shall be further provided in accordance with this specification.

3. H.V.A.C.
   a. Contractor to provide and install all necessary components as may be required for the exhaust/make-up air system(s) and condensate exhaust air system including but not limited to the fans (unless provided by the F.E.C.), ducting, gas shut-off valve(s), curbs, penetrations, dampers, controls and/or switches unless otherwise specified herein.
   b. Contractor to provide and install as required rated chase(s) as well as other separations as may be required.
   c. Contractor to provide and install all heating, ventilating, and air conditioning systems except as otherwise specified in this section.

4. Electrical by Contractor:
   a. All electrical distribution, lighting and power systems except otherwise specified in this section.
   b. Final electrical connections and inter-connections including labor and materials from point of connection on equipment to building electrical systems and required interconnections between equipment components.
   c. All electrical materials including wire, conduit, over current protection, main switches, safety cut-outs, shunt-trip breakers, disconnect switches, lightning control devices, surge protectors, uninterruptible power units and controllers.
   d. Shunt-trip breakers and/or contactors and all conduits for shut down of electrically operated cooking equipment and/or ventilation equipment as required for ventilator fire suppression system.
   e. Empty conduit systems for refrigeration system, as specified and/or shown on food service drawings.
   f. Empty conduit system for point-of-sale system, as specified and /or shown on food service drawings.
   g. Empty conduit system for fire suppression system, as specified and/or shown on food service drawings.
   h. F.E.C. shall furnish all electrically operated portable and/or movable equipment items with factory installed 3-wire or 4-wire heavy duty insulated cord with a grounded plug with one leg of the cord grounded to a conductible portion of the items frame.
   i. Furnish and install switches and/or disconnects within equipment, contactors, combination starters with fused disconnects, controls and similar items necessary for the safe and proper operation of the equipment and for compliance with all N.E.C. and/or local AHJ requirements.
   j. All switches, disconnects and/or control devices shall be safely accessible without reaching across or over any hot and/or hazardous equipment items.
   k. F.E.C. to secure cords, to the underside of the equipment, on portable and/or movable equipment as to allow ease of maintenance or as required by the Contracting Officer.

l. Install all electrical cord sets as provided by the F.E.C. as part of the foodservice equipment, install all cord sets from utility raceways to connection points on equipment.

m. When the Exhaust Hood Systems are to be furnished and installed by Division 23 and are not to be included as part of the F.E.C. work, Division 26 shall furnish and install automatic power disconnect devices (shunt trip breakers, or definite purpose contactors) with interlock to fire system micro switch, to shut off all power below the hood (including control voltage) in the event of fire system actuation. This work must be coordinated with the F.E.C. and in accordance with NFPA 17A, and NEC.

1.03 EQUIPMENT

A. Equipment, with the exception of "buy-out" or standard catalogue items, shall be fabricated in a plant bearing the name of a recognized foodservice equipment fabricator. This fabricating firm shall have been in business at least five years, with a suitable organization to design, engineer, manufacturer, deliver and install the equipment. Said installation shall be accordance with local union conditions when applicable. Such firms shall be able to refer to other successful installations of similar operating conditions. Further, the fabricator shall be able to UL classify and list the items that they fabricated. Under no circumstances shall the F.E.C. sublet any portion of the fabricated equipment to any sub-contractor without the Contracting Officer written approval. All fabricated food service equipment with inter-wiring and/or pre-wired equipment and/or refrigeration shall be manufactured by a fabricator that can UL list (or other applicable AHJ listing) and/or classify their own work.

1.04 LABOR

A. All labor shall be performed by experienced mechanics in this type of work. All work on the premises shall be done at such time as to promote the proper conduct of the project. Provide a competent on-site superintendent to supervise the work and to provide other trades with such information necessary to maintain proper conduct and timely completion of the work.

1.05 FOOD SERVICE EQUIPMENT CONTRACTORS

A. The preferred Foodservice Equipment Contractor are pre-approved (Only Local Dealers) Grady’s, United, WWest, Bargreen, Visionary Foodservice.

1.06 CODES, LAWS, AND STANDARDS

A. General Requirements:
   1. Manufacture and install equipment in conformance with the Williams-Steiger Occupational Safety and Health Act of 1970, or other Local/National safety and health regulations as applicable.
   2. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:
      a. National Fire Protection Association (NFPA)
      b. NFPA 96-Installation of equipment for removal of smoke and grease-laden vapors from commercial cooking equipment, current edition.
      c. NFPA 17 -Dry chemical extinguishing systems, current edition.
      d. NFPA 17A-Wet chemical extinguishing systems, current edition.

e. NFPA 70-National Electric Code.
f. National Sanitation Foundation (NSF)
g. Underwriter's Laboratories, Inc. (UL), including but not limited to UL-300
h. National Electric Manufacturers Association (NEMA)
i. American Gas Association (AGA)
j. American Society for Mechanical Engineers for Steam Equipment
k. National Fuel Gas Code (NFGC)
l. State Board of Health Regulations (10-D-13)

3. All electrically operated and/or heated equipment, fabricated or otherwise, shall conform to the latest standards of the National Electric Manufacturer's Association and the Underwriter's Laboratories, Inc., where applicable standards have been set up by that agency, or otherwise, such as to be acceptable to authorities having jurisdiction.
4. Note: For projects outside the U.S., compliance is required for any and/or all governing codes and regulations as may be required by the local AHJ.

1.07 SUBMITTALS

A. Equipment List:
1. Itemized list of equipment to be furnished under this contract, to include manufacturer's name and model number, along with all necessary and/or required options and/or components.

B. Samples:
1. Samples of each exposed finish material where options are available.

C. Brochures:
1. Physical or electronic complete brochures, showing each piece of standard manufactured equipment, complete with all details and/or descriptions of the manufacturer's specifications.
2. Record copy brochures, shall be delivered at the demonstration and start-up, are to be bound in booklet form, in three ring binders, and shall include the following:
a. A separate data sheet for each component or item of equipment indicating item number, description, quantity, manufacturer, model number, finishes, modifications, options, and utility requirements.
b. Catalog specification sheet and / or manufacturer's specifications and drawings complete including accessories. Arrange booklets so those items are in numeric order in accord with the contract documents with each page numbered in relation to that item. Further, include with each specification sheet and/or drawing a copy of the warranty information, operations manual and service information, as well as a completed contractor's and the food service equipment contractor's guarantee and warranty.

3. Closeout submittal:

a. One (1) complete bound set of operators' manuals and maintenance instructions containing complete description, wiring diagrams, operating data and other information pertaining to the proper operation and up-keep for the specified items of mechanical equipment having motors or other moving parts. Include names,

addresses and telephone numbers of authorized service agencies for all items with mechanical equipment as well as information of local rep.

D. Shop, Rough-in, and/or Mechanical Connection Drawings:
   1. Provide set of shop drawing prints for review and comment.
   2. Prepare rough-in drawings locating all equipment shown on the contract documents. The rough-in requirement drawing included in these documents are provided as an instrument of service and are not to be used for construction and/or reproductions. Provide drawings, in 1/4" = 1'-0" scale on sheets the same size as the contract documents, showing, with vertical and horizontal dimensions, the required rough-ins (including sleeves and conduits) for electric, gas, water, steam, sanitary waste, refrigeration, ventilation, condensation drain l lines, air and exhaust connection and wood backing for wall mounted fixtures and equipment. Show details, sections, and characteristics for slab depressions and/or other features and/or installation including data for all services in each area. Locations of equipment shall allow for traps, switches, and/or other final connection requirements. All drawings shall include floor plans showing equipment as per the contract documents, elevations, details, and sections as may be required-only required if not utilizing primary specified manufacturer. Provide this document if not using the primary specified manufacturer, then provide the above plans showing only the items that have changed and their respective requirements.
   3. Provide complete plans with dimensions showing locations and elevations of all plumbing, electrical and mechanical rough-ins if not using the primary specified manufacturer and item. Use same symbols, connection numbers, and dimensioning system as indicated in Contract Documents (scale shall be (6) 1/4" = (304) 1' - 0"). Provide the above plans showing only the items that have changed and their respective requirements.
   4. In the event rough-ins have been accomplished before the award of the contract, the Food Service Equipment Contractor shall check the existing facility and furnish all, approved equipment to suit building conditions and utilities. No extra charges shall be allowed for utility changes to fit equipment during installation and connection.
   5. Provide complete plans and details showing locations and elevations of all depressions, bases, curtain walls and hoods and any critical wall dimensions. Use same dimensioning system as indicated in Contract Documents. (Scale shall be (6) 1/4" = (304) 1' - 0")
   6. Plumbing, electrical and mechanical rough-ins all shown on the same sheet will not be accepted.
   7. Prior to fabrication, F.E.C. shall submit fabrication shop drawings for review per Division 1 specifications. Shop drawings showing plan and elevations shall be (19) 3/4" = (304) 1'-0" scale, sections shall be (38) 1-1/2" = (304) 1’-0” scale covering all fabricated items. Drawings are to show location of equipment to be coordinated with each item such as boosters mounted to underside of dishtable, garbage disposers under sink compartments. The verbiage 'By Others' is not acceptable and should be defined by trade.
   8. Fabrication details must identify all metal gauges, hardware, trim, electrical parts, special fitting and other components by manufacturer's name and model number.
   9. Foodservice Submittal Documents are to be signed by the F.E.C. to indicate they have been reviewed and coordinated with submittals by electrical, plumbing, mechanical, millwork or other trades, and meet all contract requirements. Foodservice Submittal Documents, which are not stamped and approved by the
      a. F.E.C. will be returned to as "NOT REVIEWED". The F.E.C. will be required to resubmit after review, as stated above.

E. Review:

1. Government review of rough-in drawings, shop drawing, details, and equipment is for design concept only and does not relieve the F.E.C. or Contractor of responsibility for compliance with design drawings, details and specifications, verification of utilities with equipment requirements for conformity and location and verification of all dimensions of equipment, building conditions or reasonable adjustments due to deviations. Drawings shall be prepared on the Foodservice Equipment Contractor's sheets and by his employees. Drawings of any part thereof created by photograph, paste-up, or other methods using Construction Document drawing(s) and / or details is a violation of federal copyright laws and will be returned for re-submittal. F.E.C. will assume responsibility for the proper locations and sizing of sleeves, conduits, and depressions for the various equipment requirements. F.E.C. is responsible for making multiple field inspections to verify the rough-in locations prior to the pouring of concrete, the closing of walls, etc. F.E.C. shall compensate other trades for any relocation of rough-ins.

F. Mailing and Distribution: All transparencies and/or prints shall be delivered in a mailing tube. Folded transparencies and/or prints shall be returned for re-submittal. After checking, supply the specified number of distribution prints for record purposes. All CADD drawings shall be on CD with all drawings formatted as a *.dwg or *.dfx file.

PART 2 - PRODUCTS

2.01 (SCHEDULE AT END OF SECTION)

2.02 PREFABRICATED EQUIPMENT

A. Where reference is made to a manufacturer’s model number and/or manufacturer's specifications, it is intended that the specification of that primary manufacturer is utilized as a basis of design and specification standard and has become a part of these Specifications and Documents.

B. Items and /or component parts of any item referred to by manufacturer's name and model number shall be furnished complete with all standard equipment of the manufacturer used as a basis of design and specification standards plus all extras and/or modifications hereinafter specified and/or required.

C. Similar type items and/or similar type components shall be the product by the same manufacturer to facilitate maintenance, convenience and reduce the Government's spare parts inventory.

D. Modifications to standard equipment specified shall be made by the original manufacturer, when required.

2.03 PRODUCT OR MANUFACTURER APPROVAL

A. The product of the primary manufacturer named, where more than one manufacturer is listed, was used for the basis of design and specification standard and sets the standard of quality, appearance, performance, aspect, capacities, and function for that item.

1. All manufacturers and models noted in this specification and in the Food Service Equipment drawings/schedule are Basis of Design. Alternatives may be proposed, but must be approved as equal by Contracting Officer. Contractor shall provide documentation of the equivalency of the products.

B. All manufacturers listed may not be able to supply an equipment item, pursuant to the specifications, as standardized by the primary manufacturer whose name and model number was utilized herein as the basis of design standard for this project, in which case, the listed alternate manufacturers may elect to modify an item to meet the specifications.

2.04 CONSTRUCTION

A. General:
1. The materials, components and techniques describe the construction of items of the Food Service Equipment.
2. Deviation and extra refinements peculiar to any one item will be described and/or indicated.
3. It is required that all custom/fabricated items in these plans and specifications, other than by manufacturer name and model number, will be constructed of 300 series stainless steel and be manufactured by a fabricator that can UL list and/or classify their own products.
4. All exposed surfaces of equipment shall be free of bolts, screws, and rivets. Wherever these fasteners are used they shall be an approved type constructed of stainless steel.
5. All tops, sink bowls, drain boards and troughs to be sound deadened. Component Hardware, Model Q75-1366 NSF approved gray latex sound deadener for brush or spray application, Model Tacky Tape for work top application between top and hat channel reinforcing.

B. Cooler Assembly:
1. Wall, ceiling, and floor section insulation shall be 4" thick rigid urethane. Urethane foam to have a thermal conductivity (K factor) of not more than 0.118 BTU/hr./sq. ft. per degrees Fahrenheit/inch: and an overall coefficient of heat transfer (U factor) of not more than 0.029 "R" factor shall be 34. Urethane foam when fabricated in panels shall be supplied with a fire hazard classification according to ASTM-E-84 as performed by Factory Mutual Insurance System test procedure. Panel cores shall have a flame spread rating of 25 or less and a smoke density of no greater than 450. Every panel shall bear a certifying Factory Mutual label.
2. Sectional assemblies: size / shapes indicated on drawings: 9'-0" overall height unless otherwise specified. Door locations shall be exactly as shown, size as specified.
3. Panel skin material / finish: 0.040" stucco-embossed aluminum interior and exposed exterior panel surfaces, 22 gauge galvanized concealed panel surfaces, unless otherwise specified. Beer coolers to be provided with diamond plate wall cladding as specified.
4. Integral Floor Panels:
   a. Sandwich type panels, same construction as walls/ceilings surface, with 14-gauge stainless steel interior floor surface, sealed watertight and coved at all wall lines.
   b. Field-apply (6)1/4" thick hard-alloy aluminum tread plate No. 6061-T6, with all joints caulked.
   c. Shop-install (19)3/4" marine-grade plywood sub floor below the metal skin with all surfaces sealed watertight and all joints and/or seams caulked.
   d. Treat exterior panel surfaces for concrete exposure.
   e. Sloping interior floor ramp at entrance doors. Unless otherwise specified.

5. "Floorless" Assemblies (Cooler):
    a. F.E.C. shall provide and install prefabricated mounting floor screed for perimeter and partition walls when specified. Anchor floor screed to finished slab as recommended by manufacturer. Floor screed shall be level and square. F.E.C. shall provide and install prefabricated curbs for perimeter and partition walls when specified. Anchor curb to slab recess as recommended by manufacturer. Curb shall be provided.
    b. General Contractor shall provide and install approved vapor barrier.
    c. General Contractor shall provide and install two (2) layers (50)2" thick slab Urethane unless otherwise specified, stagger each layer, and seal with an approved mastic.
    d. General Contractor shall provide a concrete slab over insulation with adequate reinforcing to receive specified finish floor and setting materials
    e. General Contractor shall provide and install floor finish to match kitchen floor, coved base (127) 5-inches high at wall lines, in setting bed, unless otherwise specified.

6. Provide 120 volt thermostatically controlled defrosters that shall be around the entire perimeter of the door, doorframe and sill.
7. Doors shall have three (3) chrome plated self-closing, cam-lift hinges, stops, hand latches with inside safety releases (panic hardware) and dead bolt locks.
8. Electric system shall be watertight installation with non-metallic conduit, fittings, junction boxes and face plates.
9. Reinforce prefabricated wall panels to rigidly support the door assemblies. Doors to be standard (914) 36" wide x (1981) 78" high unless otherwise specified. Interior door finishes in multiple compartment assemblies shall be same material as adjacent wall panels.
10. All hinged doors shall have (914) 36" high (3) 1/8" thick hard-alloy aluminum tread plates at exterior and interior unless otherwise specified.
11. Special size sections shall be constructed if changes in building dimensions, columns, or other physical obstructions will not permit standard size panel sections to be assembled as indicated on plans.
12. Provide with Cole Model No. FS-7085-SG enclosed / gasketed surface-mounted light fixtures with extended service lamps unless otherwise specified, in quantity and arrangement shown on drawings. Light fixtures to be vapor-proof. Lighting to provide a minimum of twenty (15243) 50-foot candles of light at any point inside (762) 30" above floor.
13. Light fixtures: Wired to interior and exterior compartments, 3-way Hubbel press switch per compartment, mounted in "FS" boxes with Hypalcon covers and pilot lights. Compartments with multiple entrances. Provide 4-way switches. All wiring conduit to be run on exterior of compartments.
14. Provide sectional removable closure panel at exposed top front and sides of box as required, of same material as exterior panel finish, complete with removable access panel. Panels to extend from top of box to finished ceiling. Panels to be solid faced, unless otherwise specified and shown on drawings as louvered.
15. Provide sleeves through ceiling and walls for refrigerant lines, electric sleeves and drain line, seal the balance of opening with urethane and sealant.
16. Ceiling panels where the coils are located shall be reinforced. Coils shall be located where shown on the foodservice drawings.

17. 4-(12) 1/2" diameter chrome plated, flush-mounted dial thermometer that shall be capable of calibration. All thermometers furnished with sufficient capillary tubing to extend from exterior front of the assembly to a mounting position of the sensor bulb and glycerin container within evaporator return air-stream with tubing clipped to panel.
18. Assembly shall be N.S.F constructed and U.L. rated and carry certifying labels (or other ratings and certifications as may be required by local AHJ).
19. Provide in freezer assembly a heated pressure relief port. Install pressure relief port in a wall panel away from the direct air stream flowing from the coils.
20. The manufacturer shall provide a ten-year panel warranty for the cooler and freezer sections to be free from defects in material and workmanship under normal use and service and shall be obligated to repair or replace F.O.B., any section which proves to be defective within that period for the date of original shipment. This warranty shall not include labor and freight. This warranty shall not apply to equipment, which in the consultant's opinion, has been subjected to misuse, misapplied, or improperly installed.
21. When the dimensions of an insulated room are such that a single span ceiling panel is not applicable, it must be supported using an interior or exterior beam or must be supported by all thread rods secured to the building structure. Regardless of which method is used, all beams and "C"" channels shall be aluminum. Wood and steel structures, which cause added maintenance requirements, shall not be acceptable. F.E.C. shall be responsible for the complete installation of the walk-in box structure, unless otherwise noted on contract drawings.

C. Cooler Compartments:
1. Condensing units shall be semi-hermetic air-cooled condensing units with rigid structural bases, dual receivers. OSHA metal fan guards / shrouds with venturi openings waterproof electrical system, exhaustible fusible plugs, internal inherent motor protection, liquid line shut off valves, oil pressure safety switches, crank-case heaters, pressure oil separators on low temperature units.
2. Cooler evaporating coils shall be low profile U.L. / N.S.F. as manufactured by Bohn or approved substitute, with in-line fans, cross-fin staggered copper tubing/aluminum fin coils, aluminum case, permanently lubricated motors with thermal overload protection, water-proof electrical system pre-wired to single connection and slotted channel hangers. Coils are to be designed to operate not above 34 degrees.
3. Freezer evaporating coils shall be low profile U.L. / N.S.F. as manufactured by Bohn or equal with in-line fans, cross-fin staggered copper tubing/aluminum fin coils, aluminum case, heavy duty motors with thermal overload protection, electric defrosting system, per-wired water-proof electric system and slotted channel hangers. Coils are to be designed to operate from plus 30 to minus 20 degrees temperature.
4. Refrigerant shall be type 404A in low temperature and Type R-404A in high and medium temperature systems.
5. Mounting racks shall be galvanized steel angle frames with galvanized steel floor plates. Secure in place with Phillips red head anchors or equal. Rack to be wall mounted above cooler on exterior building wall, roof mounted or located on grade with a security cover over compressors and an approved locking device.
6. Control panel housing shall be Nema-4 enclosures.
7. Freezer control panel shall be pre-wired assembly with magnetic starters, relays, condensing unit circuit breakers, coil circuit breakers, dual pressure controls, liquid line pressure gauges, suction line pressure gauges and timer.

8. Cooler control panels shall be pre-wired assembly with magnetic starters, condensing suction line pressure gauges, liquid line pressure gauges and timer.
9. Freezer timers shall be time activated, pressure terminated type with 36 to 110 pounds adjustable range, 40 amp rated switches, heavy duty self-starting motors, and 1 to 6 cycle per day defrost frequency range.
10. Cooler timers shall be time activated, time terminated type with adjustable 1 to 6 cycle per day, adjustable 4 to 100 minutes defrost duration, 40-amp switches and heavy duty synchronous industrial type motors.
11. Refrigerant circuits shall have liquid line site glasses, suction line site glasses, liquid line vibration eliminators, suction line vibration eliminators, filter dryers, automatic expansion valves, room thermostats interlocked with liquid line solenoid valves and heat exchangers.
12. Refrigerant lines shall be type ACR copper tubing with wrought copper fittings assembled by silver soldering joints. Silver soldering or silver brazing shall be done in presence of nitrogen (oil pumped) in tubing to prevent oxidation and scale formation. Refrigerant systems shall be evacuated three (3) times to a pressure of 500 microns maximum and flushed between each evacuation with refrigerant.
13. Refrigerant line supports shall be hanger rods (size variable), hinged pope hangers or support channels. Grade lines to compressors and install suction line trap adjacent to coil. Adjacent lines shall be parallel and straight with plumb vertical runs.
14. Coil drains shall be (19) 3/4" I.P.S. copper. Route and pitch (12) 1/2" per foot to external drain and secure to wall with (19) 3/4" I.P.S. cast brass or wrought copper hangers. Provide electric heaters on freezer drains. Drain lines shall be neatly insulated with (19) 3/4" thick, UL listed material similar to Armaflex. In addition, insulated drain lines shall be provided with cover of same material as compartment finish, secured to compartment walls. Drain lines shall not interfere with shelving within the compartment and shall be held to the minimum distance required to exit to an exterior drain.
15. Refrigeration line insulation shall be (38) 1-1/2" thick Armstrong Armaflex pipe insulation sealed with adhesive foam insulation. Tape fittings to sufficient thickness to prevent condensation.
16. The entire system shall be cleaned and dehydrated by maintaining a vacuum of 500 microns, or lower, for a minimum period of five (5) hours. The vacuum pump used shall itself be capable of developing a vacuum of 50 microns with its refrigerant and oil shall be added and each system shall be tested for performance.

D. Electrical:
1. Electrical conductors shall be run in rigid conduit to a junction box on exterior of fixture and have minimum (304) 12" pigtail.
2. Flexible conduit shall not be used except for motor connections.
3. Motors shall have a flexible conduit vibration section, at least (304)12" long and not over (609) 24" long, with a ground wire running through the conduit.
4. Wiring in prefabricated and / or manufactured equipment shall be U.L. approved construction by the equipment manufacturer.
5. Wiring in custom built equipment, areas, locations, or compartments where temperature may exceed 150 degrees F. shall be of Type A1 moisture proof range and appliance lead wire with nickel conductors, with an approved insulation and braided cover.
6. Wiring in custom built equipment, areas, locations, or compartments that will be exposed to moisture or high humidity shall be Type THW-75C machine wool wire with copper conductors and thermoplastic insulation. All internal wiring in custom- built equipment

shall be terminated in one (1) junction box that is accessible for connection and service. All wiring shall be permanently marked by color coding. A permanent wiring diagram shall be attached to each piece of equipment. Conductors connected to terminals shall have T & B Sta-Kon rings.

7. Conductors connected together shall have Buchanan Crimp connectors including splash caps and insulators.
8. Conductors of multi-wire branch circuits shall have two (2) wire circuits with one (1) black and one (1) white: three (3) wire circuits with one (1) black, one (1) white and one (1) blue.
9. Neutral conductors shall be white.
10. Grounding conductors shall be green.
11. Electrically operated portable equipment shall have a cord and plug.
12. Service cords shall be Type SJO with grounding conductor securely fastened to body or frame of equipment.
13. Plugs shall be grounding type with service cord grounding conductor connected to grounding blade.
14. Receptacle grounding contacts must be clearly labeled with instructions for electrician to connect this terminal or contact to branch circuit grounding conductor.
15. Electric motors shall have control switches for starters.
16. Electric motors and electric heated equipment directly connected to the building electric system shall have a positive disconnect that will open all conductors and meet NEMA standard KS-1-1957 for Type H.D. switches.
17. Combination starters and disconnects installed in a single NEMA enclosure shall have the same type components as individual starters, switch, fused switches, and breakers.
18. Starters, transformers and disconnects shall have NEMA enclosures in dry areas and watertight NEMA 4 or 5 cast enclosures in wet areas.
19. Each light fixture or group of light fixtures in the same system shall have No. 1251-1 Hubbell or equivalent Arrow-Hart or Pass and Seymour double pole press switch.
20. All equipment specified or detailed where fluorescent light fixtures are specified shall have ballasts included. All lighting fixtures furnished as part of the food service equipment contract shall include fluorescent tubes with safety coating to prevent shattering. Bulbs and tubes are to be provided and installed by the F.E.C.
21. Recessed receptacles and switches with pilot lights shall be stainless steel finish, Model R73-1210 and R-73-1212 by Component Hardware, or approved equal, specified with stainless steel faceplates.
22. Two (2) or more receptacles of the same voltage in the same equipment shall be pre-wired to a common junction box for one (1) final connection, providing total l load does not exceed 30 amps. All pre-wiring shall be done in rigid conduit with all wires color coded and tagged.
23. When counters are specified to be pre-wired to circuit breaker panel(s), F.E.C. shall provide ‘Square D’ breaker panel(s), or approved equal, sized as required to meet the equipment loads as well as local and state codes. Each panel shall be mounted within counter cabinet body behind hinged stainless-steel door as located and shown on plan. Panel(s) to have individual breakers as required and main breaker; all utilities to be on separate breakers. All wires shall be tagged, numbered, color coded, run through approved conduit and located in cabinet utility chase. All breakers shall be labeled, and unit shall be supplied wiring schematics. For counters requiring delivery in sections for re-assembly in field, each section of counter shall be pre-wired and wire ends supplied with snap-lock type connectors ready for reconnection in field. Providing rolls of wiring with counter is

unacceptable. Counter shall be complete, ready for one (1) final connection to each circuit breaker panel by Division 26.

E. Pass-Thru Trim:
1. Where pass-thru refrigerators, freezers, and/or hot food cabinets are installed through the wall, F.E.C. shall trim both sides of opening, full perimeter, with trim matching the finish of the units installed. Trim to have a continuous appearance, secured with concealed type fasteners. When units are furnished with (152) 6" high stainless-steel legs, F.E.C. shall provide a removable kick plate (toe base) to match finish of units, unless otherwise specified. Trim shall be fully sealed to wall. Exposed fasteners are not acceptable.

F. Fire Protection Systems:
1. Provide as shown and described on contract documents.

2.05 PROCEDURES

A. Workmanship:
1. Entire procedure, including materials, workmanship, details, fabrication and fastening methods shall comply with applicable standards.
2. Workmanship and finishes shall be in accordance with best practices of the trade. Only skilled workers shall be employed in the fabrication and erection of the work of this section.
3. Work shall be provided complete in every detail and the finished work shall be strong, rigid, neat in appearance and free from defects as may be determined by the Contracting Officer.

B. Welding:
1. Joints in stainless steel shall be electrically welded using stainless steel electrodes. All welds shall be free of pits and flaws. Acetylene welding or silver soldering will not be acceptable.
2. Joints in galvanized material shall be electrically welded using electrodes designed to weld galvanized metal. All welds shall be free of pits and flaws.
3. Acetylene welding will not be acceptable. Materials spot welded together shall have welds equally spaced in straight parallel or perpendicular lines. Spot welding procedure or technique is to be in strict accordance with recommendations of material and/or welding machine manufacturer.

C. Finishing:
1. Joints in stainless steel that have been welded shall be ground smooth and polished to a No. 4 finish. The grain shall be blended into the grain of surrounding surfaces.
2. Joints in galvanized material that have been welded shall be thoroughly cleaned and finished with one coat of zinc-rich paint (70% minimum). Galvanized steel shall be washed with mineral spirits, primed with Pratt and Lambert Effecto Primer or approved substitute, then spray painted with two (2) coats of Pratt and Lambert Effecto Enamel, or approved substitute of color selected by Contracting Officer. Allow eight hours minimum drying time between coat of paint and primer.
3. Powder coated items shall have a fifteen-year warranty against chipping, cracking, fading, scratching and/or damage due to temperature. Colors to be selected by Contracting Officer. Finish and materials to be approved for foodservice use by all governing agencies.

2.06 MATERIALS

A. Hardware:
   1. Hardware used in the construction of custom-built equipment shall be standard product of an approved hardware manufacturer and/or as approved by Contracting Officer. Hardware shall be heavy duty chrome plated brass (walk-in door hardware shall be Kason or approved equal) or stainless steel where specified, by Component Hardware, Keil, Grant, or Knape. All locks specified on equipment shall be of the same manufacturer, keyed alike unless otherwise requested by the Contracting Officer.

B. Stainless Steel Components:
   1. Flat sheets shall be type 304 with no.3 finish, in accordance with ASTM-A-167-70 standard. Materials shall be new, of prime quality, full gauge thickness. Stainless steel shall be type 304, 18-8 series, with a content of from 17% to 19% chrome, 7% to 10% nickel and a maximum carbon content of 0.09. Exposed surface shall be interpreted to include all inside surfaces exposed to view when item is open.
   2. Structural shapes shall be type 304 with no.3 finish on all exposed surfaces.
   3. Hardware and fittings shall be the standard product of the manufacturer named as a standard.
   4. Tubes shall be type 304, ornamental grade, with no. 4 finish, 16 gauge minimum, seamless drawn.

C. Galvanized Steel Components:
   1. Flat sheets shall be type 1, class D, in accordance with FF-QQ-S-775D standard.
   2. Structural shapes shall be galvanized by the hot dip process in accordance with ASTM-A-123-69 standards.
   3. Tubes shall be welded steel, structural grade, with hot dipped galvanized finish applied after fabrication.
   4. Pipes shall be type S, grade B, schedule 40, in accordance with ASTM-A-53-69 standard.

D. Brass Components:
   1. Flat sheets shall be 70% copper and 30% zinc alloy in accordance with ASTM B19, B36, alloy 260 half-hard finish.
   2. Brass tops are to be B & S gauge as specified.
   3. Structural sheets are to be B & S 18 gauge and seamless.
   4. Brass flat surfaces and structural shapes are to have a mirror finish.
   5. Welds are to be restored to a mirror finish and shall blend into the surface of the surrounding surfaces.

E. Copper Components:
   1. Flat sheets shall be hard copper ASTM B152, type ETP, 48 ounces per square foot.

F. Structural Steel Shapes:
   1. Angles, channels, rods, and bars used as framing members shall be extruded shapes that are uniform in cross-section, ductile in quality and free from hard spots, runs, checks or other defects.
   2. Structural shapes shall conform to ASTM-A-36-70 standard.
   3. Bent or formed sheet metal will not be acceptable as a substitute for structural materials unless prior approval in writing is obtained from Contracting Officer.

4. Where brakes are specified, they shall be adjustable, cam acting, side lever with positive brake shoe on the wheel tread.

G. Insulation:
1. Fiberglass batts shall be Johns-Manville, Owens-Corning or W.R. Grace Zonolite blanket insulation.
2. Plastic foam board insulation shall be Dupont urethane or approved substitute.
3. Insulation thickness indicated shall be foamed in place or constructed from multiple layers of board insulation of batts with staggered joints and perpendicular seams.

H. Wood:
1. Lumber shall be free from knots, pitchy seams, or other imperfections, thoroughly air-seasoned and Kiln dried. Cover all unexposed surfaces with two coats of odorless waterproof coating.
2. Plywood shall be marine grade or exterior APA grade with closed grain and of thickness specified.
3. Exposed wood surfaces to be Birch, interiors to be Cypress, Spruce or Northern White Pine. Frame casings and jambs to be clear Douglas fir.

I. Fiberglass (FRP):
1. Fiberglass Reinforced Polyester (FRP) shall be molded with permanent color, minimum thickness, (3) 1/8", glass content 33% minimum, Barcol hardness at least 55, flexural strength of 30,000 PSI minimum, tensile strength 25,000 PSI. All FRP parts shall be by manufacturer and color as selected by the Contracting Officer.
2. Fire ratings shall be as specified in Contract Documents.

J. Plastic Laminating:
1. Plastic laminated panels shall be constructed of (19) 3/4" thick marine grade plywood veneered on all exposed surfaces with plastic laminate of pattern and color as selected by Contracting Officer, Seal all unexposed sides with 1/8" Masonite.
2. Plastic and Masonite shall be pressure laminated to plywood with mastic recommended by plastic manufacturer.
3. No joints shall be permitted when standard sheet size will permit panels to be constructed without joints.
4. Grain on upright surfaces shall run vertical. All inside corners to be sealed with approved sealer as per above.

K. Quick-disconnect Assemblies:
1. Each of the following gas hose kits shall consist of stainless-steel braided hose with extruded coating, quick disconnect fitting, two (2) full flow swivel link connectors, one (1) 90-degree street elbow (when required), one (1) AGA certified gas ball valve, one (1) surelink restraining cable and all necessary hardware as manufactured by T&S Brass or Dormont.
2. Each of the following steam hose kits shall consist of stainless-steel braided hose with extruded coating, quick disconnect fitting, two (2) full flow swivel link connectors, one (1) 90-degree street elbow (when required), one (1) steam ball valve, one (1) surelink restraining cable and all necessary hardware as manufactured by T&S Brass or Dormont.
3. Each of the following water hose kits shall consist of stainless-steel braided hose with extruded coating, quick disconnect fitting, two (2) full flow swivel link connectors, one (1)

90-degree street elbow (when required), one (1) Surelink restraining cable and all necessary hardware as manufactured by T&S Brass or Dormont.

4. Each of the following flexible coiled water hose kits are for use with coffee and tea makers and similar applications requiring smaller diameter hoses for cold water connections only not to exceed 70 degrees, as manufactured by T&S Brass or Dormont.
5. F.E.C. to field verify hose length required for each application to ensure hose does not rest on floor and equipment can be moved for cleaning.

PART 3 - EXECUTION

3.01 UTILITIES, DELIVERY, STORAGE, AND SPECIAL HANDLING

A. Contractor shall provide and pay for the temporary power and light, openings, and storage space to permit scheduled delivery of equipment. See Division 01 Section "Temporary Facilities and Controls" for further clarification.

B. The F.E.C. shall verify door openings, passages, and conditions at the building. All special handling equipment charges shall be paid by the F.E.C.

C. Foodservice equipment to be delivered in factory-fabricated containers designed to protect equipment and finish until final installation. Make arrangements to receive equipment at project site, or to hold in secure warehouse until delivery can be made to job site. Coordinate all site deliveries with Contractor.

D. Store foodservice equipment in original containers, and in location to prove adequate protection to equipment while not interfering with other construction operations.

E. Handle foodservice equipment carefully to avoid damage to component enclosures and finish. Do not install damaged foodservice equipment; return damaged components to equipment manufacturer and replace as required.

3.02 CONDITIONS AND PREPARATION

A. Verify all pertinent dimensions of the building and examine conditions affecting proper execution of this section. Evaluate access to various areas for moving in of equipment and coordinate with Contractor.

B. Verify water pressure requirements and coordinate required reducing valve with Plumbing Contractor.

C. Inspect flooring and raised concrete bases, wall finishes; verify existence of required mechanical and electrical rough-ins; check painting, ceiling installation and all kitchen equipment.

D. Coordinate with project superintendent for the proper sequence for installation of equipment and wall finish.

E. Sweep clean all floor areas and tops of raised concrete bases before setting equipment in place; remove any spillage or foreign matter.

3.03 PLACEMENT

A. Do all fitting and fastening necessary to install fixed items or sub-items in permanent position as shown on plans.

3.04 ERECTION

A. Work shall be erected plumb, square and unwrapped by experienced personnel.

B. Protect all metal surfaces in contact with masonry, concrete and/or dissimilar metals with and acceptable nonabsorbent tape and/or gasket material.

C. Work shall be erected in correct horizontal and vertical alignment at the locations shown on the drawings.

D. Frames shall be anchored in place with sufficient anchorage to withstand live load with no apparent movement or tendency to fail.

E. Installation screws and fasteners shall be installed carefully to avoid scratching and/or damaging adjacent surfaces and/or fastener heads and shall be stainless steel.

F. At completion of erection work, finished surfaces shall be free of hammer and tool marks, scratches, blemishes, rust, and stains.

G. Equipment shall be suitably protected, by F.E.C. during installation to prevent damage by other trades.

H. Provide general and/or seismic restraining devices in areas requiring such, as per local codes.

3.05 CLEARANCE

A. Edges of splashes on open base fixtures that are adjacent to walls shall have a 3" cleaning clearance or be sealed, seal bead not to exceed (9) 3/8", against wall.

B. Edges of splashes on closed base fixtures that are adjacent to wall or other solid fixtures higher than the splash shall form tight hairline joints. Seal joints with transparent Geoprene, General Electric or Dow silicone sealant. All excess sealant to be cleaned out to a smooth radius fillet.

3.06 FIELD JOINTS

A. Field joints in stainless steel and/or brass tops shall be welded or fused and finished as specified herein.

B. Body joints shall be draw type with hairline joints. Provide angle bracing on each side of body joint, (9) 3/8" stainless steel diameter draw bolts, lock washer and lock nuts.

3.07 UTILITY SERVICE CONNECTIONS

A. Plumbing, electrical and mechanical furnished by the F.E.C. shall be limited to that which is built-in or is an integral part of the equipment itself.

B. Final utility installation and connections shall be by related trades and is to be included in the Contractor contracts.

C. Provide restraining devices with mobile cooking equipment as required.

3.08 CONTRACTOR COOPERATION

A. Cooperate with and render all necessary assistance to other Contractors concerned with roughing-in and final connection of utility services for this contract.

B. After final utility connections are made, thoroughly clean, sanitize, polish and inspect the proper function of all items.

C. Report malfunctioning, incomplete or missing items or components to Contracting Officer.

3.09 COORDINATION

A. It shall be the responsibility of F.E.C. to keep up to date with progress made in the field and installation of all necessary utility rough-ins required to accommodate all equipment specified, as shown on drawings and to make as many visits to the job site as is necessary to check and assure all rough-ins are being properly installed to accommodate this equipment.

B. F.E.C. to cooperate with all trades so that the end results of this work will be a professional, complete, approved, and accepted installation. Written reports of each visit shall be sent promptly to the Contracting Officer.

C. Progress of construction is of paramount importance in execution of this project. F.E.C. is to carry out his work so that no delay in the completion of this project is incurred.

D. F.E.C. is to procure all specified equipment and coordinate installation as required by project schedule.

3.10 RESERVATIONS AND CONDITIONS

A. It is the intent of this specification to complete the installation of all equipment covered herein in all phases ready for operation. F.E.C. shall carefully examine the plans and the specifications for building construction contracts and determine there from the extent of his operations in all respects. All labor and materials not included in building construction contracts necessary to accomplish the intent are hereby included in this contract.

B. F.E.C. shall attend first job meeting and subsequent job meetings, as required, for purpose of coordinating his work with other trades.

C. All equipment shall be received at the building fully protected. It will be the responsibility of the F.E.C. to protect the equipment until completely installed and accepted.

D. F.E.C. shall do all things and furnish all material necessary to carry out the full intent and meaning of these specifications.

E. F.E.C. is to be pro-active in their involvement with the project, shall monitor work in progress and coordinate their work as required to meet all schedule dates.

3.11 ACCEPTANCE

A. Prior to acceptance of the work of this Section, F.E.C. shall clean, sanitize, polish and treat all stainless steel, cast iron, enamel porcelain and other type surfaces in accordance with manufacturer's recommendations and/or procedures.

B. Prior to acceptance of this Section, F.E.C shall clean and retouch al painted surfaces, powder-coated surfaces that have been damaged must be re-finished by an established powder-coating firm.

C. Installation shall be reviewed by Contracting Officer prior to acceptance of the work.

3.12 TESTING, DEMONSTRATING, AND INSTRUCTING

A. F.E.C. shall at the completion of this work remove all debris, crating, packaging materials and implements associated with this work leaving the area broom clean.

B. F.E.C. shall provide and maintain protective covering for finished surfaces and other parts of equipment and/or cooler/freezer assemblies subject to damage during and after installation.

C. Clean, test, adjust, calibrate by a factory authorized service agency all foodservice equipment and fixtures to make ready for operation when the facility is turned over to the Government.

D. After the above is complete, all items furnished under this Contract shall be operated and thoroughly tested to insure proper safe operation. The Contracting Officer and the Contractor shall be notified of this testing and is to be provided with a copy of the service agencies' report.

E. When the food service equipment has been cleaned and tested and is operating properly, the F.E.C. shall arrange to have equipment furnished under this section of the contract demonstrated, pursuant to the availability of the Contracting Officer, by an authorized representatives who are to instruct the Government's designated personnel in the use, care and maintenance of the equipment. NOTE: Attendance at the demonstration meeting is required of all manufacturers' designated representatives providing equipment under this Contract and is to occur at one meeting.

F. The F.E.C. shall be responsible for scheduling the demonstration meeting. Each manufacturer's representative shall be present at this meeting:
   1. Demonstrate to and instruct the Government's designated personnel as to the operation, use, care, cleaning, and maintenance of all items of equipment and respond to all questions and concerns by written response.
   2. Provide the Contracting Officer with the name, address, and telephone number of a designee of each manufacturer and state which designee shall be responsible to quickly respond to warranty work 24 hours a day, 365 days a year. This is to be direct contact. The Contracting Officer may contact such warranty representatives designee directly, and such designee may respond without voiding any responsibility or warranties of the manufacturer, the F.E.C., and the Contractor. Service charges for this warranty representative, no matter what the resolution of the problem may be, shall be the responsibility of the manufacturer,

the F.E.C., and the G.C. In any event, the F.E.C. shall be responsible to immediately pay upon invoice, charges by the warranty representative in order to keep the warranty representative responsive. Whether the plumbing, electrical, food service equipment or other sub-contractors should be back charged will be resolved later.

3. Provide the Contracting Officer with six (6) sets of operation maintenance manuals for each item of equipment furnished under this contract. This set shall be neatly bound in a three-ring binder, by F.E.C. with the delivery of this booklet receipted at the time of delivery.
4. Attendance at the one demonstration meeting is required of all manufacturers representatives providing equipment under this contract, if for any reason an additional meeting must be scheduled the F.E.C. will be responsible for all additional fees and costs incurred.

3.13 CORRECTION OF DEFECTS, SERVICES, GUARANTEE, AND RESPONSIBILITIES

A. General:
1. F.E.C. shall replace, at the Contracting Officer’s discretion, or make satisfactory repairs to any item of equipment that fails to conform to the requirements of the Contract at the time and shall remedy any defects due to faulty materials or workmanship which appear within a period of one (1) year from start-up and demonstration of equipment.
2. Items shall be tested and adjusted by skilled mechanics and this Contractor shall guarantee the material and workmanship of the equipment furnished by him under these specifications, for a period of one (1) year after acceptance by Contracting Officer.
3. All equipment, refrigeration systems and ice makers shall have start-up and a two (2) year extended service warranty for parts and labor and five (5) year extended warranty on compressors which will start on the date of Contracting Officer's acceptance. All additional warranties as noted in the itemized specification shall be factory purchased warranties for each item; proof of warranties shall be provided. The cost of all warranties shall be included in the bid proposal and contract sum and shall serve as a prepaid service contract.
4. Contractors who do not normally maintain local refrigeration service personnel shall be required to provide the Contracting Officer with a refrigeration service policy in writing from local refrigeration service company that maintains a twenty-four (24) hour call service and that is acceptable to the Contracting Officer for a period of one (1) year at no additional expense to the Government.
5. Provide to Contracting Officer a listing of factory authorized service agencies and copies of written service and warranty agreements on all items of equipment provided under this contract.
6. Service contracts on refrigeration systems must be contracted for by the F.E.C. with authorized local service organizations capable of providing prompt and efficient service. Submit six copies of all service contracts, as specified herein, upon completion of the installation of the equipment to the Contracting Officer.

3.14 EXAMINATION OF PLANS AND SPECIFICATIONS

A. Plans and specifications are furnished for the use of the F.E.C. in preparing an itemized cost estimate and indicate the design intent.

B. It is the responsibility of the F.E.C. to examine all documents, which include the contract drawings and specifications, to ensure there are no typographical errors, discrepancies in quantities, drafting errors, utility information, manufacturer and model numbers, options, etc.

which would affect the outcome of a complete and professional bid. Should a model number no longer be available and/or has been replaced, the latest model shall be provided. All discrepancies and verification requests shall be brought to the attention of Contracting Officer prior to the submittal of the bid and are to be addressed in the form of a written RFI to the Contracting Officer. In the case these discrepancies and verifications are not brought to the attention of the Contracting Officer prior to the submittal of the bid, the F.E.C. will be fully responsible to furnish and provide the equipment as represented in the drawings, within reason, at no additional cost to the Government.

3.15 MISCELLANEOUS REQUIREMENTS

A. Uniform Quality:
   1. Custom built items must be constructed by the same fabricator to ensure uniform quality and appearance.
   2. Similar type items of manufacture and/or prefabricated equipment must be the product of the same manufacturer.

B. Identification Plates:
   1. Each piece of equipment must have a suitable nameplate supplied by the manufacturer that is to include the name of the manufacturer, the electrical and/or utility demands.
   2. Each switch and/or control device shall have an approved nameplate indicating its function or purpose such as display shelf lights, frost plate compressor and plate warmer.
   3. Indicator dials and other standard components of prefabricated equipment will be considered acceptable identification of their physical location clearly indicating the warmers and/or other equipment items that they control.
   4. All nameplates must be non-corrosive metal with engraved letters or have acid etched, phenolic and / or painted letters.

C. Foodservice Equipment Notes:
   1. In each item of equipment hereinafter specified under the ‘Itemized Specifications’, these specifications shall identify each respective item by name, model number, accessories, required utilities, brochure data sheets, as well as list various component parts and warranty requirements provided for same.
   2. These items and their component parts shall be of material (mounted where applicable) constructed and furnished in strict accordance to that described in the General Specifications for these items and integrally constructed where applicable. It shall be intended that where buy-out (prefabricated) items are specified, same shall be definitely furnished with all the accessories as normally furnished by manufacturer for these items. Also, in strict accordance with current manufacturer’s engineering data sheet for each respective item.
   3. All cooking equipment shall have stainless steel exterior (unless otherwise specified).
   4. All gas fired equipment to have rear gas connects where applicable.
   5. Provide POSI-SET devices at all rear casters of mobile cooking line equipment located below exhaust hoods.

FOOD SERVICE EQUIPMENT SCHEDULE

ITEM #2: EVAPORATOR COIL, COOLER

Quantity: One (1)
Type: Thermalrite
Model No.: E051545-01
SID No.: T076

Furnish and set in place per manufacturer's specifications and the following:

1. One (1) pre-assembled, hermetic, remote, air-cooled, freezer compartment refrigeration system. System to consist of condensing unit high side assembly and low profile evaporator coil low side assembly, evaporator mounting kit, automatic electric defrost system, time clock, thermostatic expansion valve, pump-down cycle kit, solenoid valve, temperature control, sight glass, drier, vibration eliminator, pressure control, crankcase heater, extreme low ambient controls, weatherproof housing, and any accessories necessary for a completely installed and functional system for a freezer box temp of +35 to +40 degrees F. Verify exact installation location with architectural plans, and site conditions.
2. Contractor's certified refrigeration mechanic to install all components supplied with the compressor, as per manufacturer's instructions. Also furnish and install refrigeration lines, insulation, refrigerant, drain line heater kit and insulation, and accessories as per manufacturer's instructions and as required.

ITEM #3: WALK-IN COOLER

Quantity: One (1)
Type: Thermalrite
Model No.: E051545-01
SID No.: T076

Furnish and set in place per manufacturer's specifications and the following:

1. Walk-in Cooler to be prefabricated of modular design and construction.
2. Panels to be interchangeable, with U.L. Labeled, CFC free urethane insulation sandwiched between interior and exterior metal surfaces, with an overall thickness of 4 inches. Edges of panels to be high-density urethane "tongue and groove", with cam-lock assemblies, set-in-place at time of fabrication. The access ports are to be on the interior, for inside assembly of the walk-in, and shall be covered with "snap caps". Interior and exterior finishes are to be manufacturer's standard white gage stucco embossed aluminum. Floor panels to have 0.80” aluminum treadplate high traffic 16 gage diamond treadplate galvanized finished floor surface. No wood will be permitted in any panels or doors.
3. One (1) 36" x 78" entrance doors and frames. Doors to be hinged as shown on plans. The doors are to be flush type, constructed and insulated in the same manner as the wall panels, and finished inside and out, to match adjacent walls. Doors and door sections to be equipped with the following:

a. Magnetic gasket, hydraulic piston driven door closer and cam lift hinges. Hardware to have

provisions for locking and a safety release to prevent entrapment of personnel within the box.

b. Provide each entrance door section with an incandescent type vapor-proof light with clear globe and heavy-duty 100-watt clear bulb to provide 50’ candles pilot light switch and conduit between switch box and outlet box. All conduit and wiring to be concealed, where possible.

c. Entrance door(s) in exterior walls of cooler/freezer to have vinyl strip curtains.

d. Freezer door section to have low wattage heater wire covered by magnetically attracting stainless steel, to provide sealing of magnetic gasket, and prevent frost and condensate buildup.

e. Unheated pressure relief ports air-vent in cooler compartment, and heated pressure relief ports air-vent in freezer compartment.

f. Audio-visual alarm for each compartment, to be included in door section, with remote sensor and adjustable alarm points to indicate the temperature inside and sound an alarm when the temperature is unsatisfactory. The alarm shall have a mute switch to silence the audible alarm and a reset button to reset the alarm once the temperature conditions are satisfactory.

4. (Lot) low temperature use fluorescent light fixtures, with heavy-duty tubes, for field installation by the Electrical Division. All light fixtures to be U.L. Listed for use inside walk-in cooler or freezer (50-foot candle). All conduit and wiring is to be concealed, where possible.

5. Matching finish trim strips, from floor to ceiling, at all exposed vertical edges, corners, and joints to building walls. Contractor to verify dimensions.

6. Matching finish closure panels from top of walk-in to finished ceiling, on exposed sides. Contractor to verify dimensions.

7. Walk-in freezer to be installed in 4” deep building floor recess. Installing contractor to verify levelness of recess/floor and provide sand and shims as necessary for a completely level walk-in floor. **A**pproximately 1/4” thick finished floor materials to be specified and provided and installed by General Contractor.

8. Unit and all components to be N.S.F. Approved, U.L. Labeled and U.L. Classified with a flame spread of 25 or less, and meet the April 1, 1998 requirements of N.S.F. Standard #7.

9. For any installation requiring additional ceiling support, provide self-supporting ceiling structural framework over the top of the walk-in compartments, and supported by the walk-in walls.

10. Verify all dimensions with building conditions for proper fit. Provide maximum size possible to fit available space, using standard panels.

11. See sheet KA3.1 Walk-in Detail drawing for additional information.

ITEM #4: CONDENSING UNIT

Quantity: One (1)
Type Thermarite
Model No.:
SID No.: T076

Furnish and set in place per manufacturer's specifications and the following:

1. One (1) pre-assembled, hermetic, remote, air-cooled, freezer compartment refrigeration system. System to consist of condensing unit high side assembly and low profile evaporator coil low side assembly, evaporator mounting kit, automatic electric defrost system, time clock, thermostatic expansion valve, pump-down cycle kit, solenoid valve, temperature control, sight glass, drier, vibration eliminator, pressure control, crankcase heater, extreme low ambient controls, weatherproof housing, and any accessories necessary for a completely installed and functional

system for a freezer box temp of +35 to +40 degrees F. Verify exact installation location with architectural plans, and site conditions.

2. Contractor's certified refrigeration mechanic to install all components supplied with the compressor, as per manufacturer's instructions. Also furnish and install refrigeration lines, insulation, refrigerant, drain line heater kit and insulation, and accessories as per manufacturer's instructions and as required

ITEM #21: AIR CURTAIN, UNHEATED

Quantity: Two (2)
Type: Mars
Model No.: EP248-1U
SID No.: T076

Furnish and set in place per manufacturer's specifications and the following:

1. Provide optional door limit switch.
2. Verify openings height.

ITEM #43: EXHAUST HOOD

Quantity: One (1)
Type: Streivor Air System
Model No.: H-01
SID No.: T076

Furnish and set in place per manufacturer's specifications and the following:

1. 18 Gauge type 304 stainless steel, including any exposed back.
2. External welded construction in accordance with the latest edition of NFPA 96. All welds to be ground and polished.
3. U.L. Classified, removable, stainless steel grease extractor type chambers.
4. Stainless steel, removable grease cans.
5. Sloped grease trough, full length below filters to grease cans.
6. Hangers, supports and miscellaneous accessories as required for installation.
7. Air space at walls to accommodate requirements of the latest edition of NFPA 96 clearance to combustibles.
8. All welded duct collars.
9. Pre-piping for hood fire suppression system.
10. Final connections to hood duct collars by the Mechanical Division.
11. Hood construction and components to be UL and NSF listed.
12. Mounting height of bottom edge of hood to be 6'-6" above finished floor (minimum and normal) to 7'-0" above finished floor (maximum).
13. Incandescent light fixtures and bulbs and tubes, U.L. listed for use in commercial cooking hoods, NSF approved.
14. Verify and coordinate all dimensions and duct requirements and locations with site conditions

and Mechanical Division.

15. See ventilation drawing sheet for general size and location of ducts.
16. If not installed against the finished ceiling, provide matching stainless steel closure panels above hood to finished ceiling, to conceal ducts and hood fire suppression system piping; verify height.
17. Provide heat sensor.

ITEM #50: FIRE SUPPRESSION SYSTEM MANUAL PULL BOX

Quantity: One (1)
Type: Ansul or kiddie
Model No.:
SID No.: T076

Furnish and set in place per manufacturer's specifications and the following:

1. Surface appliance nozzles, hood and duct protection nozzles in Exhaust Hoods, Item #44.
2. Manual pull station and micro-switches with two sets of normally open and two sets of normally closed contact points.
3. All exposed pipe and fittings to be chrome plated or stainless steel.
4. Six-month and twelve-month inspections, servicing, and replacement of components as per N.F.P.A.-96, latest edition.
5. All components and labor necessary for completely installed system in accordance with manufacturer’s listings and instructions, U.L. Standard 300, UL Standard 1254, NFPA-17A, NFPA-96, and all applicable local codes, standards, and regulations.
6. Components inside exhaust hood to be installed at hood manufacturer's shop during fabrication.
7. Provide with automatic mechanical gas shut-off valves for equipment below exhaust hood. Coordinate sizes and installation with Plumbing Division.
8. Six-month and twelve-month inspections, servicing, and replacement of components as per N.F.P.A.-96.
9. Electrical Division to provide shunt trip breakers at main power panel, or disconnects, as designated by the Electrical Engineer; interconnected with micro-switch at fire system control panel, for all electricity in and under exhaust hood. Shunt trips/disconnects to accomplish shut off of electricity in event of fire system activation.

END OF SECTION 11 40 00

SECTION 12 36 16 - METAL COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless-steel countertops at kitchen pass through window.
2. Stainless-steel wall-mounted shelves at garage.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded wall-mounted shelves.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For metal fabrications.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. For countertops, show locations and sizes of cutouts and holes for items installed in metal countertops.
3. For wall-mounted shelves, indicate requirements for blocking or reinforcements in supporting construction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products only after casework and supports on which they will be installed has been completed in installation areas.

B. Keep finished surfaces of products covered with polyethylene film or other protective covering during handling and installation.

1.5 FIELD CONDITIONS

A. Field Measurements: Where products are 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.

B. Established Dimensions: Where products are indicated to fit to other construction, establish dimensions for areas where products are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 STAINLESS-STEEL FABRICATIONS

A. Countertops: Fabricate from 0.062-inch- thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch over the substrate.

1. Joints: Fabricate countertops without field-made joints.
2. Weld shop-made joints.
3. Sound deaden the undersurface with heavy-build mastic coating.
4. Extend the top down to provide a 1-inch- thick edge with a 1/2-inch return flange.

B. Wall-Mounted Shelves: Fabricate from stainless-steel sheet, not less than 0.050-inch nominal thickness. Weld shop-made joints. Fold front edge down a minimum of 3/4 inch; fold back edge up a minimum of 3 inches. Provide integral stiffening brackets, formed by folding up ends a minimum of 3/4 inch and by welding to upturned edges.

2.2 MATERIALS

A. Stainless-Steel Sheet: ASTM A240/A240M, Type 316L.

B. Sealant for Countertops: Manufacturer's standard sealant that complies with applicable requirements in Section 079200 "Joint Sealants" and the following:

1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
2. Color: Clear.
3. Sealant shall have a VOC content of 250 g/L or less.
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 STAINLESS-STEEL FINISH

A. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

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 products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install metal countertops level, plumb, and true; shim as required, using concealed shims.

B. Field Jointing: Where possible, make field jointing in the same manner as shop jointing; use fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

C. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

D. Seal junctures of countertops, splashes, and walls with sealant for countertops.

E. Wall-Mounted Shelves: Fasten to supporting construction through upturned back edge at not less than 24 inches o.c.

1. For framed construction, fasten through wall or partition finishes directly to framing, blocking, or reinforcements.

3.3 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces. Remove and replace damaged products or touch up and refinish damaged areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 36 16

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SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface (paper/cellulose resin composite) material countertops.

a. Provide at break area, lifeguard tower lookout counter, and restrooms.

2. Solid surface (paper/cellulose resin composite) material backsplashes.

a. Provide at break areas and restrooms. See drawings.

3. Solid surface (paper/cellulose resin composite) material apron fronts.

a. Provide at ABAAS Shower room.

B. Related Requirements:

1. Section 12 36 16 "Metal Countertops" for countertop at pass through windows.
2. Section 22 42 16.13 "Commercial Lavatories" for sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator and installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Manufacturer approved installer of countertops of this type..

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities, faucets, soap dispensers, and sinks that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material - 100% post-consumer recycled paper/cellulose heat pressed with phenolic resins.

1. Basis of Design: Paperstone Designer Series Panels.
2. Alternative Manufacturers:

    a. Richlite
    b. Or Approved Equal

3. Countertop Thickness - 1.25 inches (30 mm), minimum.
4. Color: Graphite. Color to be confirmed by Contracting Officer from manufacturer's standard selection during the submittal process.
5. Finish on Exposed Surfaces - Matte, with field applied surface sealer.
6. Profile - Bullnose.

7. Back and End Splashes - same sheet material as countertops.

    a. Thickness: 1/2 inch (13 mm), minimum.
    b. Top Profile: Square
    c. Height: 4 inch minimum.
    d. Color: To Match Countertop

8. Apron - As shown on drawings.

    a. Thickness - 1/2 inch (13mm), minimum.

B. Composite Wood Products: Products shall be made without urea formaldehyde.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front 1-1/4" (32mm) full bullnose.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: None.

C. Countertops:

1. 1-1/4 inch (32mm) thick, solid surface material.

D. Backsplashes: 1/2-inch- thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints:

1. Fabricate countertops less than 8 feet without joints.
2. Fabricate countertops in sections for joining in field.

    a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
    b. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least

three splines in each joint.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color

to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

D. Install backsplashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

3.3 INSPECTION

A. Contractor will commence accessibility inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

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SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Piping materials and installation instructions common to most piping systems.
2. Concrete equipment base construction requirements.
3. Equipment nameplate data requirements.
4. Nonshrink grout for equipment installations.
5. Field-fabricated metal and wood equipment supports.
6. Installation requirements common to equipment specification sections.
7. Touch-up painting and finishing.

B. The plans and specifications are complimentary and shall be used together in order to fully describe the Work. In the case of a conflict between the plans and specifications, the plans take precedence.

C. Related Sections:

1. The following is work of Division 26 sections of the Specifications:

a. Power supply wiring from power source to power connection on equipment. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

b. Interlock wiring between field-installed equipment, except where specified as factory installed. Interlock wiring, as used in this specification, is defined as that wiring between electrically-interlocked equipment for the purpose of controlling one piece or pieces of equipment by the operation (on, off, etc.) of another piece or pieces of associated equipment.

2. Pipe and pipe fitting materials as specified in piping system sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

F. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 REFERENCES

A. Applicable Standards:

1. American Society for Testing and Materials (ASTM):

a. A47 - Ferritic Malleable Iron Castings.
b. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
c. A126 - Gray Iron castings for Valves, Flanges, and Pipe Fittings.
d. A536 - Ductile Iron Castings.
e. B32 - Solder Metal.
f. C1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
g. D709 - Laminated Thermosetting Materials.

2. American Society of Mechanical Engineers (ASME):

a. A13.1 - Scheme for the Identification of Piping Systems.
b. B1.20.1 - Pipe Threads, General Purpose (Inch).
c. B16.20 - Ring-Joint Gaskets and Grooves for Steel Pipe Flanges.
d. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
e. B18.2.1 - Square and Hex Bolts and Screws-Inch Series.
f. B31 Series - Code for Pressure Piping.

3. American Welding Society (AWS):

a. Soldering Manual, latest.
b. Brazing Manual, latest.
c. A5.8 - Filler Metals for Brazing.
d. D1.1 - Structural Welding Code for Steel.
e. D10.12 - Recommended Practices and Procedures for Welding Low Carbon Steel Pipe.

1.5 SUBMITTALS

A. Submit manufacturer’s data sheets on all system components, including the following:

1. Transition fittings
2. Dielectric fittings
3. Mechanical sleeve seals

B. General, all Division 22 sections of the Specifications: Follow the procedures specified in Division 01. Prepare maintenance manuals in accordance with Division 01.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" article of this section.

1.6 QUALITY ASSURANCE

A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

E. Materials and equipment furnished by others.

1. When equipment or materials are indicated to be furnished by others (F.B.O.) or by government furnished equipment (GFE) to the CONTRACTOR for installation and connection, the CONTRACTOR shall make a complete check of all materials and furnish a receipt to the OWNER detailing the products received and the condition of the products delivered to him. After executing the receipt and acceptance by the CONTRACTOR, the CONTRACTOR shall assume full responsibility for the safe keeping, handling, and installation of the materials and equipment furnished by others or furnished by government, until completed installation and final approval by the OWNER Technical Representative.
2. If the CONTRACTOR fails to issue said receipt it shall be assumed that all equipment and materials were then delivered to the CONTRACTOR in the proper quantities and in perfect condition.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate plumbing equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Interruption of Plumbing Utilities:

1. The Contractor shall not interrupt any main interior or exterior plumbing utility without written request for an outage and a subsequent approval of OWNER Construction Manager nor shall he interrupt any branch line to an outlet or item of equipment without approval from the OWNER Construction Manager.

2. Written request for outages shall be submitted seven calendar days in advance of the outage date. This request will delineate the particular utility or service in question, the time the service will be interrupted and the approximate hours the utility shall be off.

F. Coordinate installation of identifying devices after completion of covering and painting, where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe and Pipe Fittings:

1. Refer to individual piping system specification sections for pipe and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Materials:

1. Refer to individual piping system specification sections in Division 22 for special joining materials not listed below.
2. Solder Filler Metal: ASTM B32.
    a. Alloy Sn95 or Alloy Sn94: Tin (approximately 95%) and silver (approximately 5%), having 0.10% lead content.
    b. Alloy E: Tin (approximately 95%) and copper (approximately 5%), having 0.10% maximum lead content.
    c. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10% maximum lead content.
    d. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10% maximum lead content.
    e. Alloy Sb5: Tin (95%) and antimony (5%), having 0.20% maximum lead content.
3. Brazing Filler Metals: AWS A5.8.
    a. BCuP Series: Copper-phosphorous alloys.
    b. BAgl: Silver alloy.
4. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end, pressure pipes.
    a. Sleeve: ASTM A126, Class B, gray iron.
    b. Followers: ASTM A47, Grade 32510 or ASTM A536 ductile iron.
    c. Gaskets: Rubber.
    d. Bolts and Nuts: AWWA C111.
    e. Finish: Enamel paint.

C. Piping Specialties:

1. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
    a. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
    b. Insulating Material: Suitable for system fluid, pressure, and temperature.

c. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180°F temperature.
d. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.
e. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1) Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
2) Dielectric Couplings: Galvanized steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225°F temperature.
3) Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive, thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 225ºF temperature.

2. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.
3. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

a. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
b. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with one mechanical joint end conforming to AWWA C110 and one plain pipe sleeve end.

1) Penetrating Pipe Deflection: 5% without leakage.
2) Housing: Ductile-iron casting having water stop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
3) Pipe Sleeve: AWWA C151, ductile-iron pipe.
4) Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.

c. Cast-Iron Sleeve Fittings: Commercially made sleeve having integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.

D. Grout: Nonshrink, Nonmetallic Grout: ASTM C1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

E. Design Mix: 5000 psi, 28-day compressive strength.

2.2 ELECTRIC MOTORS

A. General: All motors (except as noted) shall conform to the following specifications:

1. Comply with requirements in this Section except when stricter requirements are specified in fire suppression equipment schedules or sections.
2. 1/2 hp and Small: Single-phase.
3. Larger than 1/2 hp shall be three-phase, except where specifically noted otherwise

4. Comply with NEMA MG 1 unless otherwise indicated.

B. Motor Characteristics:

1. Duty: Continuous duty at ambient temperature of 40 C and at site elevation.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designed speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Single Phase Motors:

1. Motors shall be one of the following, to suit starting torque and requirements of specific motor application:

    a. Permanent-split capacitor.
    b. Spilt phase.

2. Multi-speed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.3 POWER FACTOR CORRECTION

A. Capacitors shall be installed on all motors 25 hp and larger that have an uncorrected power factor of less than 90% at rated load. KVAR size shall be as required to correct motor power factor to 95% lagging.

B. Capacitors shall have:

1. Individual unit cells
2. All welded steel housings
3. Non-flammable synthetic liquid impregnant
4. Craft tissue insulation
5. Aluminum foil electrodes

2.4 Each capacitor shall be internally fused.

2.5 IDENTIFICATION

A. Equipment Labels:

1. Plastic Labels for Equipment:

    a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
    b. Letter Color: White
    c. Background Color: Black or blue.
    d. Maximum Temperature: Able to withstand temperatures up to 160 ºF.

e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
f. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
g. Fasteners: Stainless-steel rivets or self-tapping screws.
h. Adhesive: Contract-type permanent adhesive, compatible with label and with substrate.

2. Label Content: Include equipment's unique equipment number, Drawings numbers where equipment is indicated (plan, details, and schedules).
3. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the specification section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

B. Pipe Labels:

1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
2. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
3. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

a. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
b. Lettering Size: At least 1-1/2 inches high.

C. Valve Tags:

1. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

a. Tag Materials: Laminated plastic, 0.032-inch minimum thickness, and having pre-drilled or stamped holes for attachment hardware.

2. Valve Schedules: For each piping system, on 8-/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open or closed), and variations for identification. Mark valves for emergency shutoff and similar special uses.
3. Valve tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 ERECTION INSTALLATION APPLICATION

A. Piping Systems - Common Requirements:

1. General: Install piping as described below, except where system sections specify otherwise. Individual piping system specification sections in Division 22 specify piping installation requirements unique to the piping system.
2. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
3. Install piping at indicated slope.
4. Install components having pressure rating equal to or greater than system operating pressure.
5. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
6. Install piping free of sags and bends.
7. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
8. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
9. Install piping to allow application of insulation plus 1-inch clearance around insulation.
10. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
11. Install fittings for changes in direction and branch connections.
12. Escutcheons: Where uncovered exposed pipes pass through floors, finished walls, or finished ceilings, they shall be fitted with chromium-plated cast-brass plates on chromium-plated pipe, or with cast-iron or steel plates on ferrous pipe. Plates shall be large enough to completely close the holes around the pipes and shall be square, octangular, or round, with the least dimension not less than 1-1/2 inches or more than 2-1/2 inches larger than the diameter of the pipe. Plates shall be secured in an approved manner.
13. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.
14. Above Grade, Exterior Wall, and Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

    a. Install steel pipe for sleeves smaller than 6 inches.
    b. Install cast-iron wall pipes for sleeves 6 inches and larger.
    c. Assemble and install mechanical seals according to manufacturer's printed instructions.

15. Below Grade, Exterior Wall, and Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
16. Below Grade, Exterior Wall, and Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.
17. Verify final equipment locations for roughing in.
18. Refer to equipment specifications in other sections of these specifications for roughing-in requirements.
19. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system specification sections.

    a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
c. Soldered Joints: Construct joints according to AWS "Soldering Manual."
d. Brazed Joints: Construct joints according to AWS "Brazing Manual."
e. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
f. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

20. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

a. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inches or smaller threaded pipe connection.
b. Wet Piping Systems (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

B. Equipment Installation - Common Requirements:

1. Install equipment to provide the maximum possible head room, where mounting heights are not indicated.
2. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the OWNER.
3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
4. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
5. Install equipment giving right-of-way to piping systems installed at a required slope.

C. Painting and Finishing:

1. Field painting requirements are specified in Division 09.
2. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

D. Identification Tags and Labels:

1. Materials:

a. Pipe Labels: Pipe labels shall be self-adhesive labels, all temperature Perma-Code pipe markers No. B-500, manufactured by the W. H. Brady Company. The background color code for all markers shall conform to the American National Standard ANSI A-13.1 "Scheme for the Identification of Piping Systems." This standard establishes four basic backgrounds as follows: Yellow for dangerous materials, bright blue for protective materials, red for fire protection equipment, and green for safe materials.
b. Tags: Tags shall be aluminum, laminated plastic 2" x 1" minimum with edges ground smooth or rolled. Each tag shall be punched to receive tie wires or chain. Letters and Numbers shall be evenly spaced and stamped or engraved into the surface.

2. Installation:

a. Identification of Piping:

1) Identify all piping according to the following procedures:

a) Bare pipes to be marked shall first be wiped clean of dirt, dust, grease, and moisture. Markers to be installed on painted piping shall be applied only after completion of final coat of paint. Insulated pipes shall first be painted to a smooth, hard surface in the area the label is to be applied. Labels shall be applied, using pressure, so that it lies smooth and flat. After application on insulated pipes, the label shall be stapled securely to the insulation. The labels shall be applied to the pipe so that the lettering is in the most legible position. For overhead piping apply markers on the lower half of the pipe where view is unobstructed, so that markers can be read at a glance from floor level. The wording on the labels shall correspond directly to the wording in the mechanical symbol lists, regardless of whether or not it is standard wording for the designated manufacturer.

b) Use an arrow marker with each pipe content marker. The arrow shall always point away from the pipe marker and in the direction of flow, with background color and height the same as content marker. If flow can be in both directions, use two arrow markers.

c) Apply pipe marker and arrow marker at each valve, at every point of pipe entry or exit through wall or ceiling, on each riser and branch of tee, and every 20 feet on long continuous lines or at every bay or aisle to show proper identification of pipe content and direction of flow.

b. Valves: All main service valves located inside the building shall be tagged and identified as to the type of service. All valves controlling branch mains or risers to various portions of the building shall be tagged and identified as to the areas served.

c. Controls: All automatic controls, control panels, zone valves, pressure electric, electric pressure switches, relays and starters shall be clearly tagged and identified. Wording shall be identical to that on the control diagram in the contract drawings.

d. Pumps: All pumps shall be identified as to service with laminated plastic tags tightly secured to the pump.

E. Erection of Metal Supports and Anchorage:

1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
2. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."

F. Cutting and Patching:

1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for plumbing installations. Perform cutting by skilled mechanics of the trades involved.
2. Repair cut surfaces to match adjacent surfaces.

G. Grouting:

1. Install nonmetallic, nonshrink grout for plumbing equipment base bearing surfaces, pump and other equipment base plates and anchors. Mix grout according to manufacturer's printed instructions.

2. Clean surfaces that will come into contact with grout.
3. Provide forms for placement of grout, as required.
4. Avoid air entrapment when placing grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases to provide a smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION 220500

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SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Stainless Steel Type: With setscrew fastener.

B. Split-Plate, Stamped-Stainless-Steel Type: With concealed hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Insulated Piping: One-piece stainless-steel.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stainless-steel.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stainless-steel.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Pressure gages.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Liquid-filled and sealed type(s); stainless steel with minimum 2.5” nominal diameter.

C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

D. Connector Type(s): Union joint adjustable angle rigid, with unified-inch screw threads.

E. Connector Size: ½ inch, with ASME B1.1 screw threads.

F. Stem: 0.25 in diameter; stainless steel.

G. Window: Plain glass

H. Ring: Stainless steel.

I. Element: Bimetal coil.

J. Pointer: Dark-colored metal.

K. Accuracy: Plus or minus 1.5 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

1. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
2. Standard: ASME B40.200.
3. Case: Stainless Steel ; nominal size.
4. Case Form: Back angle Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass

8. Stem: Stainless steel of length to suit installation.
    a. Design for thermowell installation: Bare stem.
9. Connector: with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1.5 percent of scale range

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES or CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS ½, NPS ¾, OR NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: ½, ¾, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Sealed type; plastic ; 4-1/2 nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS ¼ or NPS ½, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi
7. Pointer: Dark-colored metal.
8. Window: plastic.
9. Accuracy**:** Grade A, plus or minus 1 percent of middle half of scale range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of one-third of pipe diameter to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

K. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

M. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 220519

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SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic water valves intended to convey or dispense water for human consumption must comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or must be certified to be in compliance with NSF 61 and NSF 372 (by an ANSI-accredited third-party certification body) that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for cast copper solder-joint connections.
4. ASME B16.22 for wrought copper and copper alloy solder-joint connections.
5. ASME B31.9 for building services piping valves.

C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Type:

1. Hand Lever: For quarter-turn valves.

G. Valves in Insulated Piping:

1. Provide extended neck stems.
2. Extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two Piece with Full Port and Brass Trim, Threaded or Soldered Ends:

1. Standard: MSS SP-110; MSS SP-145.
2. CWP Rating:
3. Body Design: Two piece.
4. Body Material: Forged brass.
5. Ends: Threaded or soldered.
6. Seats: PTFE.
7. Stem: Brass.
8. Ball: Chrome-plated brass.
9. Port: Full.

B. Brass Ball Valves, Two Piece with Full Port and Brass Trim, Press Ends:

1. Standard: MSS SP-110; MSS SP-145; IAPMO/ANSI Z1157.
2. CWP Rating: Minimum .
3. Body Design: Two piece.
4. Body Material: Forged brass.
5. Ends: Press.
6. Press-End Connections Rating: Minimum .
7. Seats: PTFE or RPTFE.
8. Stem: Brass.
9. Ball: Chrome-plated brass.
10. Port: Full.
11. O-Ring Seal: Buna-N or EPDM.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:

1. Standard: MSS SP-110; MSS SP-145.
2. CWP Rating:
3. Body Design: Two piece.
4. Body Material: Bronze.
5. Ends: Threaded or soldered.
6. Seats: PTFE.
7. Stem: Bronze or brass.
8. Ball: Chrome-plated brass.
9. Port: Full.

B. Bronze Ball Valves, Two Piece with Full Port, and Bronze or Brass Trim, Press Ends:

1. Standard: MSS SP-110; MSS SP-145; IAPMO/ANSI Z1157.
2. CWP Rating: Minimum .
3. Body Design: Two piece.
4. Body Material: Bronze.
5. Ends: Press.
6. Press-End Connections Rating: Minimum .
7. Seats: PTFE or RTPFE.
8. Stem: Bronze or brass.
9. Ball: Chrome-plated brass.

10. Port: Full.
11. O-Ring Seal: EPDM or Buna-N.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.

B. Provide support to piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position to allow full valve actuation movement.

F. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

G. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

H. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves exhibiting leakage.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, provide the same types of valves with higher CWP ratings.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe 2”and Smaller:

1. Brass ball valves, two piece with full port, and brass trim. Provide with threaded, solder, or press-connection-joint ends.

2. Bronze ball valves, two piece with full port, and bronze or brass trim. Provide with threaded, solder, or press-connection-joint ends.

END OF SECTION 220523.12

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Restrained elastomeric isolation mounts.
3. Housed-spring isolators.
4. Housed-restrained-spring isolators.
5. Pipe-riser resilient support.
6. Snubbers.
7. Restraints - cable type.
8. Restraint accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal:

1. For each seismic-restraint device, including seismic-restrained mounting, pipe-riser resilient support, snubber, seismic restraint, seismic-restraint accessory, and concrete anchor and insert, that is required by this Section or is indicated on Drawings, submit the following:

a. Seismic restraint, and vibration isolator. Select vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data.
b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
c. Concrete Anchors and Inserts: Include calculations showing anticipated seismic loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
d. Seismic Design Calculations: Submit all input data and loading calculations prepared in "Performance Requirements" Article in "Seismic Design Calculations" Paragraph.

2. Seismic Restraint Detail Drawing:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and

values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Coordinate seismic restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.

3. Product Listing, Preapproval, and Evaluation Documentation: By an evaluation service member of ICC-ES or OSHPD, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
4. All delegated-design submittals for seismic- and wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
6. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports:

C. Seismic Qualification Data: Provide special certification for designated seismic systems as indicated in ASCE/SEI 7-16, Paragraph 13.2.2, "Special Certification Requirements for Designated Seismic Systems" for all Designated Seismic Systems identified as such on Drawings or in the Specifications.

1. Provide equipment manufacturer's written certification for each designated active plumbing seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7 and AHRI 1270, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to ASCE/SEI 7-16.
2. Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in ASCE/SEI 7-16.
3. Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by a licensed professional engineer.
4. The following plumbing systems and components are Designated Seismic Systems and require written special certification of seismic qualification by manufacturer:

    a. Water Heaters.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Seismic Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: ICC-ES product listing or UL product listing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design seismic control system.

1. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7-16.

B. Seismic Design Calculations:

1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-16. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the section text.

a. Data indicated below to be determined by Delegated-Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
b. Building Occupancy Category:
c. Building Risk Category:
d. Building Site Classification:

2. Calculation Factors, ASCE/SEI 7-16, Ch. 13 - Seismic Design Requirements for Nonstructural Components: All section, paragraph, equation, and table numbers refer to ASCE/SEI 7-16 unless otherwise noted.

a. Horizontal Seismic Design Force F_p: Value is to be calculated by Delegated-Design Contractor using Equation 13.3-1. Factors below must be obtained for this calculation.

1) S_{DS} = Spectral Acceleration: Value applies to all components on Project.
2) a_p = Component Amplification Factor:
3) I_p = Component Importance Factor:
4) W_p = Component Operating Weight: For each component. Obtain by Delegated-Design Contractor from each component submittal.
5) R_p = Component Response Modification Factor:
6) z = Height in Structure of Point of Attachment of Component for Base: Determine from Project Drawings for each component by Delegated-Design Contractor. For items at or below the base, "z" shall be taken as zero.
7) h = Average Roof Height of Structure for Base: Determine from Project Drawings by Delegated-Design Contractor.

b. Vertical Seismic Design Force: Calculated by Delegated-Design Contractor using method explained in ASCE/SEI 7-16, Paragraph 13.3.1.2.

c. Seismic Relative Displacement D_{pI}: Calculated by Delegated-Design Contractor using methods explained in ASCE/SEI 7-16, Paragraph 13.3.2. Factors below must be obtained for this calculation:

1) D_p = Relative Seismic Displacement that Each Component Must Be Designed to Accommodate: Calculated by Delegated-Design Contractor in accordance with ASCE/SEI 7-16, Paragraph 13.3.2.
2) I_e = Structure Importance Factor: Value applies to all components on Project.
3) δ_{xA} = Deflection at Building Level x of Structure A:
4) δ_{yA} = Deflection at Building Level y of Structure A:
5) δ_{yB} = Deflection at Building Level y of Structure B:
6) h_x = Height of Level x to which Upper Connection Point Is Attached: Determine for each component by Delegated-Design Contractor from Project Drawings and manufacturer's data.
7) h_y = Height of Level y to which Upper Connection Point Is Attached: Determine for each component by Delegated-Design Contractor from Project Drawings and manufacturer's data.
8) Δ_{aA} = Allowable Story Drift for Structure A:
9) Δ_{aB} = Allowable Story Drift for Structure B:
10) h_{sx} = Story Height Used in the Definition of Allowable Drift Δ_a:

d. Component Fundamental Period T_p: Calculated by Delegated-Design Contractor using methods explained in ASCE/SEI 7-16, Paragraph 13.3.3. Factors below must be obtained for this calculation:

1) W_p = Component Operating Weight: Determined by Contractor from Project Drawings and manufacturer's data.
2) g = Gravitational Acceleration: 32.17 fps^2
3) K_p = Combined Stiffness of the Component, Supports, and Attachments: Determined by delegated-design seismic engineer.

C. Consequential Damage: Provide additional seismic restraints for suspended plumbing components or anchorage of floor, roof or wall mounted plumbing components as indicated in ASCE/SEI 7-16 so that failure of a non-essential or essential plumbing component will not cause the failure of any other essential architectural, mechanical or electrical building component.

D. Fire/Smoke Resistance: Seismic restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.

E. Component Supports:

1. Load Ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-16 Section 13.6.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
4. Surface Pattern: Smooth, ribbed, or waffle pattern.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

    a. Housing: Cast-ductile iron or welded steel.
    b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top housing with attachment and leveling bolt.

2.5 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.6 PIPE-RISER RESILIENT SUPPORT

A. All-Directional, Acoustical Pipe Anchor Consisting of Two Steel Tubes Separated by a Minimum 1/2-inch Thick Neoprene:

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.7 SNUBBERS

A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Post-installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be seismically prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-14 Ch. 17 for 2015 or 2018 IBC. Preset concrete inserts: Seismically prequalified in accordance with ICC-ES AC446 testing.
2. Anchors in Masonry: Design in accordance with TMS 402.
3. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
4. Resilient Cushion: Maximum 1/4-inch air gap, and minimum 1/4 inch thick.

2.8 RESTRAINTS - CABLE TYPE

A. Seismic Restraint Cables: ASTM A492 stainless steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.

B. Restraint cable assembly and cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge type end fittings do not comply and are unacceptable.

2.9 RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Stainless steel tube or stainless steel slotted-support-system sleeve with internally bolted connections to hanger rod. Non-metallic stiffeners are unacceptable.

B. Hinged and Swivel Brace Attachments: Multifunctional stainless steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static and seismic load within specified loading limits.

3.2 INSTALLATION OF VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICES

A. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork.

B. Installation of vibration isolators and seismic restraints must not cause any stresses, misalignment, or change of position of equipment or piping.

C. Equipment Restraints:

1. Install snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

D. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

E. Install seismic restraint cables so they do not bend across edges of adjacent equipment or building structure.

F. Install seismic restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Provide flexible connections in piping systems where they cross structural seismic joints and other points where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7.

3.4 ADJUSTING

A. Adjust isolators after system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform tests and inspections.
2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
4. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
5. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
6. Test to 90 percent of rated proof load of device.
7. Measure isolator restraint clearance.
8. Measure isolator deflection.
9. Verify snubber minimum clearances.
10. Test and adjust restrained-air-spring isolator controls and safeties.

B. Remove and replace malfunctioning units and retest as specified above.

C. Units will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, with predrilled holes for attachment hardware.
2. Letter and Background Color: As indicated for specific application under Part 3.
3. Maximum Temperature: Able to withstand temperatures of up to 160 deg F (71 deg C).
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
5. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances of up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, with predrilled holes for attachment hardware.

B. Letter and Background Color: As indicated for specific application under Part 3.

C. Maximum Temperature: Able to withstand temperatures of up to 160 deg F (71 deg C).

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

E. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances of up to 72 inches (1830 mm), and

proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

F. Fasteners: Stainless steel rivets

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

B. Letter and Background Color: As indicated for specific application under Part 3.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of plumbing equipment.

B. Sign and Label Colors.

1. White letters on an ANSI Z535.1 safety-green background.

C. Locate equipment labels where accessible and visible.

3.4 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Within 3 ft. (1 m) of each valve and control device.
2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Within 3 ft. (1 m) of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft. (8 m) along each run. Reduce intervals to 10 ft. (3 m) in areas of congested piping and equipment.

C. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

D. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe-Label Color Schedule:

1. Domestic Water Piping: White letters on an ANSI Z535.1 safety-green background.
2. Sanitary Waste Piping: White letters on a black background.

END OF SECTION 220553

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SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.4 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields

B. Coordinate clearance requirements with piping installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.5 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," and "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.

1. Preformed Pipe Insulation: Type I, Grade A**,** unfaced with factory-applied with factory-applied ASJ-SSL
2. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. Materials shall be compatible with insulation materials, jackets, and substrates.

2.4 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: -40°F-250°F.
3. Color: White.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

2.7 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, ½ inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal ¾ inch wide, stainless steel.

C. Wire: stainless steel soft-annealed.

2.8 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the contract documents, unless otherwise approved by the engineer-of-record.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

E. Insulation Installation at Structural Steel Beam:

1. Pipe: Install insulation continuously through the beam. Insulation can be compressed at penetration through beam only.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached

insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.5 INSTALLATION OF GLASS-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Contracting Officer, by removing field-applied jacket and insulation in layers in reverse order of

their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

B. All insulation applications will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS Smaller than 1: Insulation shall be one of the following:
    a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
2. NPS 1 to less than 1-1/2: Insulation shall be one of the following:
    a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1.5 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS Smaller than 1: Insulation shall be one of the following:
    a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
2. NPS 1 to less than 1-1/2: Insulation shall be one of the following:
    a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1.5 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:
    a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 220719

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SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

B. Related Requirements:

1. Section 331415 "Site Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building up through the slab.
2. Section 220519 "Meters and Gages for Plumbing Piping" for water meters and gauges inside the building.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 61, and NSF 372.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type L.

B. Annealed-Temper Copper Tube: ASTM B88, Type L.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

E. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

F. Wrought Copper Unions: ASME B16.22.

G. Copper Tube, Pressure-Seal-Joint Fittings:

1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
2. Minimum 200-psig working-pressure rating at 250 deg F.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B32, lead-free alloys.

B. Flux: ASTM B813, water flushable.

C. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F. .
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.

4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed or solderedjoints.
2. Hard copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3.2 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install valves according to the following:

1. Section 220523.12 "Ball Valves for Plumbing Piping."

D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

E. Install domestic water piping level without pitch and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

G. Install seismic restraints on piping.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gauges on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."

Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing".

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices.

B. Install hangers for copper piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping within 12 inches of each fitting.

D. Support vertical runs of copper to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2 and larger.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers for domestic water piping.
7. Hose bibbs.
8. Wall hydrants.
9. Water-hammer arresters.

B. Related Requirements:

1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome plated

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.
4. Size: NPS 2.
5. Body: cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2.
6. End Connections: Threaded for NPS 2 and smaller.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:

a. Valves NPS 2: Ball type with threaded ends on inlet and outlet.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
c. Vandal Resistant Cage: ASSE 1060, stainless steel, and insulated cover.

2.5 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 200 psig minimum CWP.
3. Size: NPS 2 or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass or stainless steel.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Standard: ASSE 1070.
2. Pressure Rating: 125 psig.

3. Type: Thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded union inlets and outlet.
6. Accessories:
    a. Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
    b. Undergrade, stainless steel, meter box sized for two (2) meters with isolation valves on both sides.
7. Valve Finish: Rough-Bronze

B. Primary, Thermostatic, Water Mixing Valves:

1. Standard: ASSE 1017.
2. Pressure Rating: minimum unless otherwise indicated.
3. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded union inlets and outlets.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Finish: Rough Bronze
8. Piping Finish: Copper.

2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller.
3. End Connections: Threaded for NPS 2 and smaller; flanged.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
    a. Strainers NPS 2 and Smaller: 0.020 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.8 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Copper.
3. Seat: Copper, replaceable.
4. Supply Connections: NPS ½ or NPS ¾ threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral**,** nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Include operating key with each operating-key hose bibb.
9. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.9 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed exposed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: Coordinated with location in wall and pipe size.
6. Outlet, concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Bronze
9. Outlet, exposed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Operating Keys(s): Two with each wall hydrant.

2.10 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.

C. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

E. Y-Pattern Strainers: For water, install on supply side of each control valve water pressure-reducing valve solenoid valve and pump.

F. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

D. Adjust each reduced-pressure-principle backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.6 FIELD QUALITY CONTROL

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

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221123.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: UL 778 for motor-operated water pumps.

C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

D. Seismic Performance: Inline, domestic-water pumps shall withstand the effects of earthquake motions determined according to ASCE and SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Component Importance Factor: 1.5.

2.2 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

B. Pump Construction:

1. Casing:

a. Radially split bronze brass with threaded companion-flange connections for pumps with threaded pipe connections

b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
c. Gauge port tappings at suction and discharge nozzles.

2. Impeller: Bronze or brass, statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
5. Bearings: permanently lubricated ball type.
6. Minimum Working Pressure: 125 psig
7. Continuous Operating Temperature: 220 F

C. Motor: Single speed, with grease-lubricated ball bearings; resiliently or rigidly mounted to pump casing.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Enclosure: NEMA 250, Type 1
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V ac

B. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V ac
6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with HI 1.4.

B. Mount pumps in orientation complying with manufacturer's written instructions.

C. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.

1. Comply with requirements for hangers and supports.

D. Install thermostats in hot-water return piping.

E. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

F. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats and timers for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.

C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

    a. Horizontally mounted, in-line, close-coupled centrifugal pumps.

D. Install shutoff valve and strainer on suction side of each pump, and check, and shutoff, valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."

3.3 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between temperature controllers and devices.

C. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123.21

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hubless, cast-iron soil pipe and fittings.
2. PVC pipe and fittings.
3. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product data.

1.3 INFORMATIONAL SUBMTTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

B. Field quality-control reports.

1.4 WARRANTY

A. Manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10 ft. head of water.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings:

1. ASTM A888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C1277 and CISPI 310.
2. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C1277 and ASTM C1540.

2. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.4 HUBLESS, CAST IRON EPOXY COATED

A. Pipe and Fittings

1. Pipe, Hubless ASTM A888 or CISPI 301
2. Couplings, Hubless ASTM C1277, ASTM C1540, or CISPI 310
3. All cast iron soil pipe shall be clearly marked with the manufacturer's name, pipe diameter, relevant ASTM standard and registered trademark of 3rd party certifier. 3rd party certifier shall be IAPMO, ICC-ES, UL or other organization that is accredited by ANSI.
4. Interior of cast iron soil pipe shall be bored for smoothness prior to the application of coatings. All coatings shall be sprayed for consistent coverage.
5. Cast iron pipe shall be epoxy coated cast iron soil pipe. Epoxy coated pipe shall be tested for corrosion resistance from 2pH to 12 pH, high temperature resistance to 205 F, salt spray resistance, flame resistance and temperature cycling. Epoxy coated cast iron soil pipe shall have an epoxy thickness of 5 mils on the interior and 2.5 mils on the exterior. Couplings: Heavy duty couplings with 80 in-lbs required to torque the bolts with EPDM seals shall be used.

2.5 PVC PIPE AND FITTINGS

A. Comply with NSF 14 for plastic piping components. Include "NSF-dwv" marking for plastic drain, waste, and vent piping and "NSF-sewer" marking for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D3034, SDR 35, sanitary drain, waste, and vent.

C. PVC Socket Fittings: ASTM D3034, made in accordance with ASTM D3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
    a. Standard: ASTM C1173.
    b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.
    d. Sleeve Materials:
        1) For Cast-Iron Soil Pipes: ASTM C564, rubber.
4. Shielded, Nonpressure Transition Couplings:

a. Standard: ASTM C1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
   1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
   2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
      a. Straight tees, elbows, and crosses may be used on vent lines.
   3. Do not change direction of flow more than 90 degrees.
   4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
      a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
    b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary waste gravity-flow piping.
    a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing”.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing”.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment"

1. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42 clamps.
5. Install individual, straight, horizontal piping runs:

    a. 100 Ft. and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Ft. if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52 spring hangers.

C. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within 12 inches of each fitting**,** valve, and coupling.

E. Support vertical runs of cast-iron soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
    a. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller are to be any of the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground grease waste piping NPS 4 and smaller are to be any of the following:

1. Hubless, cast-iron epoxy coated soil pipe and fittings with heavy-duty hubless-piping couplings and fittings.

D. Aboveground, vent piping NPS 4 and smaller is to be any of the following:

1. For vent through roof: Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

2. For venting other than vent through roof: Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Underground, soil, waste (non-grease), and vent piping are to be any of the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Underground, grease soil and waste piping NPS 4 and smaller are to be any of the following:

1. Hubless, cast-iron epoxy coated soil pipe and fittings with heavy-duty hubless-piping couplings and fittings.

END OF SECTION 221316

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SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Miscellaneous sanitary drainage piping specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping.
3. Body Material: cast-iron soil pipe T-branch Hubless, as required to match connected piping.
4. Closure: Countersunk plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: cast-iron soil pipe T-branch Hubless, as required to match connected piping.
4. Closure Plug:

a. Brass
b. Countersunk head.
c. Drilled and threaded for cover attachment screw.
d. Size: Same as or not more than one size smaller than cleanout size.

5. Wall Access, Cover Plate: Round, deep, stainless steel cover plate with screw.
6. Wall Access, Frame and Cover: Square, stainless steel wall-installation frame and cover.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Inline Trap Seal:

1. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
2. Material: Polymer.

3. Standard: Tested and certified in accordance with ASSE 1072.
4. Listing: ICC-ES or IAPMO listed.
5. Size: Same as floor drain outlet or strainer throat.

B. Floor-Sink, Inline Trap-Seal:

1. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
2. Material: Polymer.
3. Standard: Tested and certified in accordance with ASSE 1072.
4. Listing: ICC-ES or IAPMO listed.
5. Size: Same as floor drain outlet or strainer throat.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Assemble open drain fittings and install with top of hub 2 inches above floor.

E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

F. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

G. Install vent caps on each vent pipe passing through roof.

H. Install wood-blocking reinforcement for wall-mounting-type specialties.

I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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SECTION 221414 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. 316 Stainless Steel pipe and fittings.
2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. 316 Stainless Steel pip and fittings.
2. Specialty pipe fittings.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

1.4 QUALITY ASSURANCE

A. Provide materials bearing label, stamp, or other markings of specified testing agency.

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are to be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

B. Seismic Performance: Storm drainage piping and support and installation to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

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1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully functional after the seismic event."
2. Component Importance Factor: 1.0.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 STAINLESS-STEEL PIPE AND FITTINGS

A. Stainless Steel Pipe: Type 316 or 316L, ASTM A312/A312M, with wall thickness as indicated in "Piping Applications" Article.

B. Stainless Steel Pipe Fittings:
1. Threaded Fittings:
   a. ASME B16.11 and ASTM A182.
   b. Type 316 or 316L.

2. Butt Welded:
   a. Fabricated of same material and thickness as piping for butt welding.
   b. ASME B16.9 and ASTM A182.
   c. Type 316 or 316L.

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Shielded, Nonpressure Transition Couplings:
   a. Standard: ASTM C1460.
   b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
   c. End Connections: Same size as and compatible with pipes to be joined.

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PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

B. Install piping as indicated unless deviations from layout are approved on coordination drawings.

C. Install piping in concealed locations.

1. Piping installed in equipment rooms, service areas, and where indicated may be exposed.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

1. Do not change direction of flow more than 90 degrees.
2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of drainage piping in direction of flow is prohibited.

J. Install piping at the following minimum slopes unless otherwise indicated.

1. Building Storm Drain: 1/4 inch per foot downward in direction of flow for piping NPS 3 and smaller; 1/8 inch per foot downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm Drainage Piping: 1/4 inch per foot downward in direction of flow.

K. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.

L. Plumbing Specialties:

1. Install drains in storm drainage gravity-flow piping.

a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

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M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.2 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

B. Join stainless-steel pipe and fittings with gaskets in accordance with ASME A112.3.1.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
1. Install stainless steel pipe hangers for horizontal piping.
2. Install stainless steel pipe support clamps for vertical piping.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

C. Install hangers for piping with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

E. Support vertical piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

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B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.
   1. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.5 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

      a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

   2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

      a. Expose work that was covered or concealed before it was tested.

   3. Test Procedure:

      a. Test storm drainage piping on completion of roughing-in.
      b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
      c. From 15 minutes before inspection starts until completion of inspection, water level must not drop.
      d. Inspect joints for leaks.

   4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   5. Prepare reports for tests and required corrective action.

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3.6 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

3.7 PROTECTION

A. Protect piping and drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day and when work stops.

C. Repair damage to adjacent materials caused by storm drainage piping installation.

3.8 PIPING SCHEDULE

A. Aboveground storm drainage piping NPS 6 and smaller is to be the following:
   1. 316 or 316L stainless steel pipe and fittings; threaded or welded fittings and joints.

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SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

1.1 SUMMARY

A. Section Includes:

1. General-purpose roof drains.

B. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for penetrations of roofs.
2. Section 078413 "Penetration Firestopping" for firestopping roof penetrations.

1.2 ACTION SUBMITTALS

A. Product Data:

1. General-purpose roof drains.

1.3 QUALITY ASSURANCE

A. Provide drainage piping specialties are to bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 GENERAL-PURPOSE ROOF DRAINS

A. Stainless Steel Roof Drains.

1. 316 Stainless Steel Medium-Sump, General-Purpose Roof Drains:
   a. Standard: ASME A112.6.4.
   b. Body Material: 316 Stainless Steel.
   c. Dimension of Body: 8- to 15-inch diameter.
   d. Dome Material: Galvanized cast iron.
   e. Combination flashing ring and gravel stop.
   f. Outlet: Bottom.
   g. Outlet Type: Butt-weld or Threaded.
   h. Options:
      1) Flow-control weirs.
      2) Underdeck clamp.
      3) Perforated Gravel Guard: Stainless steel.
      4) Vandal-proof dome.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains in accordance with roof membrane manufacturer's written installation instructions at low points of roof areas.

1. Install flashing collar or flange of roof drain to maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

B. Install test tees in vertical conductors and near floor.

C. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.

1. Comply with requirements in Section 078413 "Penetration Firestopping."

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221414 "Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 INSTALLATION OF FLASHING

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

3.4 CLEANING

A. Clean piping specialties during installation and remove dirt and debris as work progresses.

3.5 PROTECTION

A. Protect piping specialties during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day and when work stops.

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SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, electric, storage, domestic-water heaters.
2. Commercial, light-duty, storage, electric, domestic-water heaters. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for commercial domestic-water heaters, accessories, and components, from manufacturer.

B. Product Certificates: For each type of commercial and tankless, electric, domestic-water heater.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Storage, Domestic-Water Heaters: EWH-1

1) Storage Tank: Three years.
2) Controls and Other Components: One year.

b. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters: EWH-2

1) Storage Tank: Six years.
2) Controls and Other Components: One year.

c. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. Seismic Performance: Commercial, electric, domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified "

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Standard: UL 1453.
2. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.

a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.

b. Pressure Rating: 150 psig.

3. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium. Qty 2
b. Drain Valve: Corrosion-resistant metal with hose-end connection.
c. Insulation: Comply with ASHRAE/IES 90.1.
d. Jacket: Steel with enameled finish or high-impact composite material.
e. Heating Elements: Electric, screw-in or bolt-on immersion type
f. Temperature Control: Adjustable thermostat.
g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater.

4. Special Requirements: NSF 5 construction.

B. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1. Standard: UL 174.

2. Storage-Tank Construction: Steel, vertical arrangement.

    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig.

3. Factory-Installed, Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal with hose-end connection.
    d. Insulation: Comply with ASHRAE/IES 90.1.
    e. Jacket: Steel with enameled finish or high-impact composite material.
    f. Heating Elements: Electric, screw-in immersion type.
    g. Temperature Control: Adjustable thermostat.
    h. Safety Control: High-temperature-limit cutoff device or system.
    i. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater.

4. Special Requirements: NSF 5 construction

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

2. Construction:

    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than 1-1/2” with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1 ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE/IES 90.1 ASHRAE 90.2.

E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-

pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

F. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.

G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water. Seismic rated.

2.4 SOURCE QUALITY CONTROL

A. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base.

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, or suspended platform.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping."

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices.

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains.

F. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

H. Fill electric, domestic-water heaters with water.

I. Charge domestic-water expansion tanks with air to required system pressure.

J. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

K. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION 223300

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor-mounted, bottom-outlet water closets.
2. Toilet seats.
3. Supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Comply with ASME A112.19.2/CSA B45.1 for water closets.
2. Comply with IAMPO/ANSI Z124.5 for water-closet (toilet) seats.
3. Comply with ASME A112.6.1M for water-closet supports.
4. Comply with ICC A117.1 for ADA-compliant water closets.
5. Comply with ASME A112.4.3 for plastic fittings used in connection of vitreous china water closets to sanitary drainage systems.
6. Comply with US EPA WaterSense Specifications for HETs

2.2 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets - Floor Mounted, Bottom Outlet, Close-Coupled FlushometerTank:

1. Bowl:

a. Material: Vitreous china.
b. Type: High Efficiency Toilet (HET)
c. Style: Flushometer tank, gravity pressure assisted.
d. Height: Standard ADA compliant.
e. Rim Contour: Elongated.
f. Water Consumption:1.28 gallons per flush.
g. Color: White

2. Toilet Seat: Open Front, less cover. Elongated plastic, four ring bumpers. Self-sustaining check-hinges with non-corroding stainless steel posts and pintles.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

1. Install level and plumb.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

B. Install toilet seats on water closets.

C. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.

3.3 PIPING CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

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SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vitreous-china, under-counter-mounted lavatories.
2. Vitreous-china, wall-mounted lavatories.
3. Automatically operated lavatory faucets.
4. Supply fittings.
5. Waste fittings.
6. Lavatory supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, UNDER-COUNTER-MOUNTED LAVATORIES

A. Lavatory - Oval, Vitreous China, Undercounter Mounted:

1. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For undercounter mounting.
c. Nominal Size: Oval, 19.25” x 15.75”
d. Faucet-Hole Punching: No holes.
e. Faucet-Hole Location: On countertop.
f. Color: White.
g. Mounting Material: Sealant and undercounter mounting kit.

2. Faucet:

a. Standard: ASME A112.18.1 Compliant
b. Type: Counter mounted
c. ADA Compliant
d. Manual operation
e. 0.5 gpm flow rate
f. Aerated spray
g. 4” trim plate
h. Polished Chrome

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory - Rectangular, Vitreous China, Wall Mounted, with Back:

1. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: Rectangular, 20”x18.25”
d. Faucet-Hole Punching: One hole
e. Faucet-Hole Location: Top.
f. Rear-overflow
g. Color: White.
h. Mounting: Concealed arm
i. ADA Compliant

2. Faucet:

a. Standard: ASME A112.18.1 Compliant
b. Type: Counter mounted
c. ADA Compliant
d. Manual operation
e. 0.5 gpm flow rate
f. Aerated spray
g. 4” trim plate
h. Polished Chrome

3. Support: concealed-arm lavatory carrier Include rectangular, steel uprights.
4. Lavatory Mounting Height: ADA Compliant.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key

F. Risers:

1. ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with offset and straight tailpiece.

C. Trap:

1. Size: 2 inches.

a. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with thick brass tube to wall two-piece, and chrome-plated, brass or steel wall flange.

2.5 LAVATORY SUPPORTS

A. Lavatory Carrier:

1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories.

3.2 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.3 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.4 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Contracting Officer.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service sinks.
2. Kitchen sinks.
3. Supply fittings.
4. Waste fittings.
5. Grout.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SERVICE SINKS

A. Service Sinks - Molded Stone, Floor Mounted: MSB-1.

1. Fixture:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Shape: Square.
c. Nominal Size: 24 by 24 inches (610 by 610 mm).
d. Height: 10 inches (255 mm).
e. Rim Guard: On front.
f. Color: White.
g. Drain: Grid with NPS 3 (DN 80) outlet.

2. Mounting: On floor and flush to wall.

B. Commercial Service Sink Faucets - Manual Type

1. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch (20-mm) hose thread end, integral vacuum breaker, inlets 8 inches (200 mm) o.c., and two-handle mixing.
3. Faucet:

a. Standards:

1) ASME A112.18.1/CSA B125.1.
2) NSF 61.
3) ICC A117.1.

b. Finish: Rough chrome plated.
c. Handles: Lever.
d. Cartridges: One-fourth turn compression.
e. Brace: Adjustable top brace.

2.2 KITCHEN SINKS

A. Kitchen Sinks - Stainless Steel, Counter Mounted: S-1.

1. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Stainless steel, self-rimming, sound-deadened unit with ledge back.
c. Number of Compartments: One.
d. Overall Dimensions: 25” x 21-1/4”
e. Material: 18 gauge, Type 304 stainless steel.
f. Compartment:

1) Dimensions: 21” x 15-3/4”.
2) Drain: NPS 3-1/2 (DN 90) tailpiece with stopper**.**
3) Drain Location: Near back of compartment.
4) Depth: Wheelchair accessible.

B. Manually Operated Sink Faucets

1. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. Commercial Sink Faucets - Manual Type: Single-control mixing.

a. Standard: ASME A112.18.1/CSA B125.1.
b. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
c. Body Type: Single hole with 8” escutcheon.
d. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
e. Finish: Chrome plated.
f. Maximum Flow Rate: 1.5 gpm
g. Mounting Type: Deck, concealed.
h. Valve Handle(s): Lever.
i. Spout Type: Swivel gooseneck with pull down hose.
j. Vacuum Breaker: Not required.
k. Spout Outlet: Aerated Stream or Spray.

3. Supply Fittings:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

        1) Operation: Loose key.
        2) Risers: NPS 1/2 (DN 15), ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

4. Waste Fittings:

    a. Standard: ASME A112.18.2/CSA B125.2.
    b. Trap(s):

        1) Size: NPS 2 (DN 50).
        2) Material:

            a) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall and chrome-plated brass or steel wall flange.

    c. Continuous Waste:

        1) Size: NPS 2 (DN 50).
        2) Material: Chrome-plated, 17-gauge brass tube.

5. Mounting: On counter with sealant.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2 (DN 15).
2. ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain:

1. Service sinks: Grid type with NPS 3 (DN 80) offset and straight tailpiece.
2. Kitchen/utility sinks: To garbage disposal.

C. Trap:

1. Service sinks:

a. Size: NPS 3 (DN 80).
b. Material:

1) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

2.5 GROUT

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install sinks level and plumb in accordance with rough-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping".
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.2 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.3 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.4 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

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SECTION 224223 - COMMERCIAL SHOWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Individual showers.
2. Shower heads and shower valves.
3. Grout.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Shower valves intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 INDIVIDUAL SHOWERS

A. Individual, Sectional, PMMA Showers without Top: SH-1.

1. General: PMMA shower floor with valve, receptor, and appurtenances.
2. Standard: CSA B45.5/IAPMO Z124.
3. Style: Standard residential.
4. Shower Head with Single-Handle, Pressure-Balanced Mixing Valve:

a. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; and shower head.
b. Shower Valve:

1) Standards: ASME A112.18.1/CSA B125.1.
2) Body Material: Solid brass.
3) Finish: Polished chrome plate.
4) Mounting: Exposed.
5) Operation: Single-handle, twist or rotate control.
6) Antiscald Device: Integral with mixing valve.
7) Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

c. Supply Connections: NPS 1/2 (DN 15).
d. Shower Head:

1) Standard: ASME A112.18.1/CSA B125.1.
2) Type: Ball joint with arm and flange.
3) EPA WaterSense: Required.
4) Shower Head Maximum Flow Rate: 1.5 gpm (5.7 L/min.).
5) Shower Head Material: Metallic with chrome-plated finish.
6) Spray Pattern: Fixed.
7) Integral Volume Control: Not required.
8) Temperature Indicator: Integral with shower valve.

5. Shower Nominal Size and Shape: 48 by 34 inches (1219 by 915 mm) rectangular**.**
6. Color: White.
7. Outlet: Drain with NPS 2 (DN 50) outlet.
8. Shower Rod and Curtain: Required.

B. Individual, Sectional, PMMA Showers without Top: SH-3.

1. General: PMMA shower enclosure with valve and receptor and appurtenances.
2. Standard: CSA B45.5/IAPMO Z124.
3. Style: Handicapped/accessible.
4. Handheld Shower with Single-Handle, Pressure-Balanced Mixing Valve:

a. Description: Single-handle, accessible, pressure-balance mixing valve with hot- and cold-water indicators; diverting valve check stops; and hose with handheld shower.
b. Shower Valve:

1) Standards: ASME A112.18.1/CSA B125.1.
2) Body Material: Solid brass.
3) Finish: Polished chrome plate.
4) Mounting: Exposed.
5) Operation: Single-handle, twist or rotate control. Handheld shower has non-positive shut-off.
6) Antiscald Device: Integral with mixing valve.
7) Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

c. Supply Connections: NPS 1/2 (DN 15).
d. Shower Head:

1) Standard: ASME A112.18.1/CSA B125.1.
2) Type: Hose with handheld shower.
3) EPA WaterSense: Required.
4) Shower Head Maximum Flow Rate: 1.5 gpm (5.7 L/min.)
5) Shower Head Material: Metallic with chrome-plated finish.
6) Spray Pattern: Fixed.
7) Integral Volume Control: Not required.
8) Temperature Indicator: Integral with shower valve.

5. Shower Nominal Size and Shape: 36 by 36 inches (915 by 915 mm) square.
6. Color: White.
7. Outlet: Drain with NPS 2 (DN 50) outlet.

8. Shower Rod and Curtain: Required.
9. Grab Bar: ASTM F446, mounted on support area back wall.

2.3 SHOWER HEADS AND SHOWER VALVES

A. Shower Head with Single-Handle, Pressure-Balanced Mixing Valve: SH-2.

1. Description: Single-handle, accessible, pressure-balance mixing valve with single temperature metering; diverting valve check stops; and foot shower.
2. Shower Valve:

a. Standards: ASME A112.18.1/CSA B125.1.
b. Body Material: Solid brass.
c. Finish: Stainless steel.
d. Mounting: Exposed.
e. Operation: Single-handle, twist or rotate control.
f. Antiscald Device: Integral with mixing valve.
g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

3. Supply Connections: NPS 1/2 (DN 15).
4. Shower Head:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Type: Integral with mounting flange.
c. EPA WaterSense: Required.
d. Shower Head Maximum Flow Rate: 1.6 gpm.
e. Shower Head Material: Solid brass, triple chrome-plated.
f. Spray Pattern: Adjustable.
g. Integral Volume Control: Required.
h. Temperature Indicator: Single temperature.

2.4 GROUT

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb.

C. Install ball valves in water-supply piping to the shower if supply stops are specified with the shower valve. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping"**.** Install valves in locations that are accessible for ease of operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Set shower receptors in leveling bed of cement grout.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant.

3.2 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.3 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at shower valves to produce proper flow.

3.4 CLEANING AND PROTECTION

A. After completing installation of showers, inspect and repair damaged finishes.

B. Clean showers, shower valves, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers for temporary facilities unless approved in writing by Contracting Officer.

END OF SECTION 224223

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Equipment nameplate data requirements.
2. Nonshrink grout for equipment installations.
3. Field-fabricated metal equipment supports.
4. Installation requirements common to equipment specification sections.
5. Cutting and patching.
6. Touch-up painting and finishing.

B. The plans and specifications are complimentary and shall be used together in order to fully describe the Work. In the case of a conflict between the plans and specifications, the plans take precedence.

C. The engineer has based the drawings and design on non-certified information furnished by various equipment manufacturers. It is incumbent on the part of the CONTRACTOR to include in the bid all material and labor needed to install the actual equipment furnished.

D. Related Sections:

1. The following is work of Division 26 sections of the Specifications:

a. Power supply wiring from power source to power connection on equipment. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

b. Interlock wiring between field-installed equipment, except where specified as factory installed. Interlock wiring, as used in this specification, is defined as that wiring between electrically-interlocked equipment for the purpose of controlling one piece or pieces of equipment by the operation (on, off, etc.) of another piece or pieces of associated equipment.

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

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. Submit manufacturer’s data sheets on all system components, including the following:

1. Transition fittings
2. Dielectric fittings
3. Mechanical sleeve seals
4. Escutcheons

B. General, all Division 23 sections of the Specifications: Follow the procedures specified in Division 1. Prepare maintenance manuals in accordance with Division 1 sections of the Specifications.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the “Quality Assurance” article of this section.

1.5 QUALITY ASSURANCE

A. Qualify welding processes and operators for structural steel according to AWS D1.1.

B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

C. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

D. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

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

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

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

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

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect flanges, fittings, and ducting specialties from moisture and dirt.

B. Materials and equipment furnished by others.

1. When equipment or materials are indicated to be furnished by others (F.B.O.) or by owner furnished equipment (OFE) to the CONTRACTOR for installation and connection, the CONTRACTOR shall make a complete check of all materials and furnish a receipt to the owner detailing the products received and the condition of the products delivered to him. After executing the receipt and acceptance by the CONTRACTOR, the CONTRACTOR shall assume full responsibility for the safe keeping, handling, and installation of the materials and equipment furnished by others or furnished by government, until completed installation and final approval by the engineer and owner.

2. If the CONTRACTOR fails to issue said receipt it shall be assumed that all equipment and materials were then delivered to the CONTRACTOR in the proper quantities and in perfect condition.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical ducting, and equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate installation of identifying devices after completion of covering and painting, where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MATERIALS

1. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.
2. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
    a. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
    b. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with one mechanical joint end conforming to AWWA C110 and one plain pipe sleeve end.
        1) Penetrating Pipe Deflection: 5% without leakage.
        2) Housing: Ductile-iron casting having water stop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
        3) Pipe Sleeve: AWWA C151, ductile-iron pipe.
        4) Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.
    c. Cast-Iron Sleeve Fittings: Commercially made sleeve having integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.

B. Grout: Nonshrink, Nonmetallic Grout: ASTM C1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000 psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 ERECTION INSTALLATION APPLICATION

A. Mechanical Systems - Common Requirements:

1. General: Install ducting as described below, except where system sections specify otherwise. Individual piping system specification sections in Division 23 specify piping installation requirements unique to the piping system.
2. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of mechanical systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install as indicated, except where deviations to layout are approved on coordination drawings.
3. Install components having pressure rating equal to or greater than system operating pressure.
4. Install ducting free of sags and bends.
5. Install ducting tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
6. Install ducting to allow application of insulation plus 1-inch clearance around insulation for all exterior insulated ducts and pipes.
7. Install fittings for changes in direction and branch connections.
8. Escutcheons: Where uncovered exposed ducts pass through floors, finished walls, or finished ceilings, they shall be fitted with chromium-plated cast-brass plates on chromium-plated pipe, or with cast-iron or steel plates on ferrous pipe. Plates shall be large enough to completely close the openings around the ducts and pipes and shall be square, octangular, or round, with the least dimension not less than 1-1/2 inches or more than 2-1/2 inches larger than the diameter of the duct/pipe. Plates shall be secured in an approved manner.
9. Verify final equipment locations for roughing in.
10. See equipment specifications in other sections of these specifications for roughing-in requirements.

B. Equipment Installation - Common Requirements:

1. Install equipment to provide the maximum possible head room, where mounting heights are not indicated.
2. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the engineer.
3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
4. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
5. Shaft Alignment: All motors and pumps (or drives) connected by a shaft coupling, whether factory or field assembled, shall be aligned during installation using a dial indicator applied to both ends of both shafts for a full 360 degrees prior to operation. Alignment of the shafts shall be less than the maximum allowable tolerances as recommended by the coupling or equipment manufacturer. Alignment of shafts shall be rechecked after several hours of operation and equipment has reached operating temperature.

C. Painting and Finishing:

1. Field painting requirements are specified in Division 9 sections of the Specifications.
2. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

D. Identification Tags and Labels:

1. Materials:

a. Tags: Tags shall be laminated plastic 2" x 1" minimum with edges ground smooth or rolled. Each tag shall be punched to receive tie wires or chain. Letters and Numbers shall be evenly spaced and stamped or engraved into the surface.

2. Installation:

a. Controls: All automatic controls, control panels, zone valves, pressure electric, electric pressure switches, relays and starters shall be clearly tagged and identified. Wording shall be identical to that on the control diagram in the contract drawings.

E. Erection of Metal Supports and Anchorage:

1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
2. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."

F. Cutting and Patching:

1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
2. Repair cut surfaces to match adjacent surfaces.

G. Grouting:

1. Install nonmetallic, nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates and anchors. Mix grout according to manufacturer's printed instructions.
2. Clean surfaces that will come into contact with grout.
3. Provide forms for placement of grout, as required.
4. Avoid air entrapment when placing grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases to provide a smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION 230500

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fastener systems.
2. Equipment supports.

B. Related Requirements:

1. Section 230548 "Vibration and Seismic Controls for HVAC" Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
2. Section 233113 "Metal Ducts" for duct hangers and supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
2. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.3 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.4 MATERIALS

A. Carbon Steel: ASTM A1011/A1011M.

B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

C. Stainless Steel: ASTM A240/A240M.

D. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Division 01 for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus.

3.2 HANGER AND SUPPORT INSTALLATION

A. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

C. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

E. Install lateral bracing with pipe hangers and supports to prevent swaying.

F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 4 mil.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Use hangers and supports with galvanized metallic coatings for equipment that will withstand the harsh marine salt environment.

B. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Elastomeric hangers.
9. Spring hangers.
10. Snubbers.
11. Restraints - rigid type.
12. Restraints - cable type.
13. Restraint accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated Design Submittals:

1. For each seismic-restraint and wind-load protection device, including seismic-restrained mounting, snubber, seismic restraint, seismic-restraint accessory, concrete anchor and insert, and restrained isolation roof-curb rail that is required for support in the seismic zone., submit the following:

a. Seismic and Wind-Load Restraint, and Vibration Isolation Base Selection: Select vibration isolators, seismic and wind-load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
c. Concrete Anchors and Inserts: Include calculations showing anticipated seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
d. Seismic Design Calculations: Submit all input data and loading calculations prepared under "Seismic Design Calculations" Paragraph in "Performance Requirements" Article.
e. Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.

f. Qualified Professional Engineer: All designated-design submittals for seismic- and wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.

2. All delegated design submittals for seismic- and wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
3. Product Listing, Preapproval, and Evaluation Documentation: By an evaluation service member of ICC-ES UL FM Approvals OSHPD an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and basis for approval (tests or calculations).

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Welding certificates.

C. Field quality-control reports.

D. Seismic Qualification Data: Provide special certification for designated seismic systems as indicated in ASCE/SEI 7-16, Paragraph 13.2.2, "Special Certification Requirements for Designated Seismic Systems" for all Designated Seismic Systems identified as such on Drawings or in the Specifications.

1. Provide equipment manufacturer's written certification for each designated active mechanical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7 and, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction or experience data as permitted by ASCE/SEI 7-05, ASCE/SEI 7-10, and ASCE/SEI 7-16.
2. Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in ASCE/SEI 7-16.
3. Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by a licensed professional engineer.

E. Wind-Force Performance Certification: Provide special certification for HVAC components subject to high wind exposure and impact damage.

1. Provide equipment manufacturer's written certification for each designated HVAC device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.
2. Provide manufacturer's written certification for each designated louver, damper, or similar device, stating that it will remain in place and protect opening from penetration of windborne debris and comply with all requirements of authorities having jurisdiction.
3. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic- and Wind-Load-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: ICC-ES product listing UL product listing FM Approvals an evaluation service member of ICC-ES an agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design seismic and wind- load control system.

1. Seismic and Wind-Load Performance: Equipment to withstand the effects of earthquake motions and high wind events determined in accordance with ASCE/SEI 7-16.

B. Seismic Design Calculations:

1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-16 Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the Section Text.

a. Data indicated below to be determined by Delegated Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
b. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
c. Building Occupancy Category:
d. Building Risk Category:
e. Building Site Classification:

C. Wind-Load Design Calculations:

1. Perform calculations to obtain force information necessary to properly select wind-load-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-16 Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition

referred to in this subparagraph is intended as referenced throughout the Section Text unless otherwise noted.

a. Coordinate design wind-load calculations with seismic load calculations for equipment requiring both seismic and wind-load reinforcement. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.

D. Consequential Damage: Provide additional seismic restraints for suspended HVAC components or anchorage of floor-, roof-, or wall-mounted HVAC components as indicated in ASCE/SEI 7-16 so that failure of a non-essential or essential HVAC component will not cause failure of any other essential architectural, mechanical, or electrical building component.

E. Fire/Smoke Resistance: Seismic- and wind-load-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.

F. Component Supports:

1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-16 Section 13.6.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
4. Surface Pattern: Smooth, ribbed, or waffle pattern.
5. Infused nonwoven cotton or synthetic fibers.
6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Resilient and elastomeric

a. Surface Pattern: Smooth, ribbed, or waffle pattern.
b. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

2. Elastomeric Material: Molded, oil- and water-resistant neoprene rubber, silicone rubber, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
    a. Housing: Cast-ductile iron or welded steel.
    b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.5 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.6 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases limit floor load to 500 pisg.
    b. Top housing with attachment and leveling bolt threaded mounting holes and internal leveling device elastomeric pad.

2.7 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
    a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases limit floor load to 500 psig.
    b. Top plate with threaded mounting holes elastomeric pad.
    c. Internal leveling bolt that acts as blocking during installation.
2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:
1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

B. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

2.9 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.10 SNUBBERS

A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be seismically prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-14 Ch. 19 for 2021 IBC.
2. Preset Concrete Inserts: Seismically prequalified in accordance with ICC-ES AC446 testing.
3. Anchors in Masonry: Design in accordance with TMS 402.
4. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
5. Resilient Cushion: Maximum air gap, and minimum thick.

2.11 RESTRAINTS - RIGID TYPE

A. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.12 RESTRAINTS - CABLE TYPE

A. Seismic-Restraint Cables: ASTM A492 stainless steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.

B. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.13 RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections Reinforcing steel angle clamped to hanger rod. Non-metallic stiffeners are unacceptable.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.14 POST-INSTALLED CONCRETE ANCHORS

A. Mechanical Anchor Bolts:

1. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.

B. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-16, Ch. 13.

1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

C. Expansion-type anchor bolts are not permitted for equipment in excess of that is not vibration isolated.

1. Undercut expansion anchors are permitted.

2.15 CONCRETE INSERTS

A. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC466 testing.

B. Comply with ANSI/MSS SP-58.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static, wind load, and seismic loads within specified loading limits.

3.2 INSTALLATION OF VIBRATION-CONTROL, WIND-LOAD CONTROL, AND SEISMIC-RESTRAINT DEVICES

A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.

B. Provide seismic-restraint and wind-load control devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork,

D. Installation of vibration isolators, wind-load restraints, must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

E. Comply with requirements in other seproject specifications for installation of roof curbs, equipment supports, and roof penetrations.

F. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds.
3. Install seismic-restraint, and wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES OSHPD an agency acceptable to authorities having jurisdiction that provides required submittals for component.

G. Ductwork Restraints:

1. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems.", SMACNA's "Seismic Restrain Manual: Guidelines for Mechanical Systems - OSHPD Edition.", ASCE/SEI 7. See Section 233113 "Metal Ducts" for Seismic Hazard Level (SHL). See Section 233113 "Metal Ducts" for "Connection Level" performance requirement for OSHPD jurisdictions.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than.
4. Select seismic-restraint devices with capacities adequate to carry static and seismic loads.
5. Install cable restraints on ducts that are suspended with vibration isolators.

H. Install seismic- and wind-load-restraint cables so they do not bend across edges of adjacent equipment or building structure.

I. Install seismic- and wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES OSHPD an agency acceptable to authorities having jurisdiction that provides required submittals for component.

J. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

K. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

L. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

M. Mechanical Anchor Bolts:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors to be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7.

3.4 ADJUSTING

A. Adjust isolators after system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.5 FIELD QUALITY CONTROL

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

B. Tests and Inspections:

1. Perform tests and inspections with the assistance of a factory-authorized service representative.

2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
4. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
5. Test no fewer than four of each type and size of installed anchors and fasteners selected by Architect.
6. Test to 90 percent of rated proof load of device.
7. Measure isolator restraint clearance.
8. Measure isolator deflection.
9. Verify snubber minimum clearances.
10. Test and adjust restrained-air-spring isolator controls and safeties.

C. Remove and replace malfunctioning units and retest as specified above.

D. Units will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 230548

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SECTION 230553 - IDENTIFICATION FOR HVAC DUCT AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, thick, with predrilled holes for attachment hardware.
2. Letter and Background Color: As indicated for specific application under Part 3.
3. Maximum Temperature: Able to withstand temperatures of up to .
4. Minimum Label Size: Length and width vary for required label content
5. Minimum Letter Size: for name of units if viewing distance is less than , for viewing distances of up to , and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

B. Letter and Background Color: As indicated for specific application under Part 3.

C. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, ½ inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

F. Fasteners: Stainless steel rivets.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter and Background Color: As indicated for specific application under Part 3.

C. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

E. Minimum Letter Size: ¼ inch for name of units if viewing distance is less than 24 inches, ½ inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

F. Fasteners: Stainless steel rivets.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings. Also include the following:

1. Duct size.
2. Flow-Direction Arrows: Include flow-direction arrows on main distribution ducts. Arrows may be either integral with label or may be applied separately.
3. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of mechanical equipment.

B. Sign and Label Colors:

1. White letters on an ANSI Z535.1 safety-blue background

C. Locate equipment labels where accessible and visible.

3.4 INSTALLATION OF DUCT LABELS

A. Install plastic-laminated self-adhesive duct labels showing service and flow direction with permanent adhesive on air ducts.

1. Provide labels in the following color codes:

a. For air supply ducts: White letters on blue background
b. For air return ducts: White letters on blue background
c. For exhaust-, outside-, relief-, return-, and mixed-air ducts: White letters on blue background.

END OF SECTION 230553

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:

a. Constant-volume air systems.

2. Testing, adjusting, and balancing of equipment.
3. Testing, adjusting, and balancing of existing HVAC systems and equipment.
4. Procedures for exhaust hoods.
5. Duct leakage tests verification.
6. HVAC-control system verification.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.4 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC.

B. TAB Specialists Qualifications, Certified by NEBB or TABB:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

E. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.5 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.

F. Examine equipment performance data, including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units and verify that they are accessible and their controls are connected and functioning.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.

4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:

1. Motors.
2. Fans and ventilators.
3. Air curtains.
4. Terminal units.
5. Commercial kitchen hoods.
6. Radiant heaters.

7. Unit heaters.
8. Condensing units.
9. Heating-only makeup air units.
10. Finned-tube radiation heaters.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' Record drawings duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
    c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Owner **y** for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR EXHAUST HOODS

A. Room Pressure: Measure and record room pressure with respect to atmosphere and adjacent space with hoods in room initially not operating and then with hoods operating.

B. Makeup Air: Systems supplying source of makeup air to hoods shall be in operation during testing and balancing of exhaust hoods.

1. Measure and record temperature of makeup air entering hood. If hood makeup air is from multiple sources having different temperatures, measure and record the airflow and temperatures of each source and calculate the weighted average temperature.
2. Use simulated smoke to observe supply air-distribution air patterns in vicinity of hoods. Consult with hood manufacturer and report conditions that have a detrimental effect on intended capture, containment, and other attributes effecting proper operation.

C. Kitchen Hoods:

1. Type 1: Measure and record pressure drop and face velocity of hood filters and slots in accordance with hood manufacturer's instructions. Consult hood manufacturer to determine hood airflow using recorded information.
2. Type 2: Measure and record airflow by duct traverse.
3. Capture and Containment: Check each hood for proper capture and containment using a smoke-emitting device. Observe and report performance. Make adjustments to achieve optimum results.

D. AHJ Tests: Conduct additional tests required by authorities having jurisdiction.

3.9 DUCT LEAKAGE TESTS

A. Witness the duct leakage testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified limits.

C. Report deficiencies observed.

3.10 HVAC CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify HVAC control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.11 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.12 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.

B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.

3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms, including the following:

    a. Settings for outdoor-and exhaust-air dampers.
    b. Conditions of filters.
    c. Face and bypass damper settings at coils.
    d. Fan drive settings, including settings and percentage of maximum pitch diameter.
    e. Settings for pressure controller(s).
    f. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Terminal units.
4. Balancing stations.
5. Position of balancing devices.

E. Electric-Coil Test Reports: For electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

    a. System identification.
    b. Location.
    c. Coil identification.
    d. Capacity in BTUH.
    e. Number of stages.
    f. Connected volts, phase, and hertz.
    g. Rated amperage.
    h. Airflow rate in CFM.
    i. Face area in square feet.
    j. Minimum face velocity in ft/sec.

2. Test Data (Indicated and Actual Values):

    a. Heat output in BTUH.
    b. Airflow rate in CFM.
    c. Air velocity in ft/sec.
    d. Entering-air temperature in degrees Fahrenheit.
    e. Leaving-air temperature in degrees Fahrenheit.
    f. Voltage at each connection.
    g. Amperage for each phase.

F. Fan Test Reports: For supply, and exhaust fans, include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches, and bore.
    h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and speed.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.
    g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in CFM.
    b. Total system static pressure in psi.
    c. Fan speed.
    d. Discharge static pressure in psi.
    e. Suction static pressure in psi.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System fan and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in degrees Fahrenheit.
    d. Duct static pressure in psi.
    e. Duct size in inches.
    f. Duct area in inches.
    g. Indicated airflow rate in CFM.
    h. Indicated velocity in ft/sec.

i. Actual airflow rate in CFM.
j. Actual average velocity in ft/sec.
k. Barometric pressure in psi.

H. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in square feet.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in CFM.
b. Air velocity in ft/sec.
c. Preliminary airflow rate as needed in CFM.
d. Preliminary velocity as needed in ft/sec.
e. Final airflow rate in CFM.
f. Final velocity in ft/sec.
g. Space temperature in degrees Fahrenheit.

3.14 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Owner.

B. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day .

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.

2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.15 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Related Requirements:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," and "Indoor Duct and Plenum Insulation Schedule," articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type III with factory-applied FSK. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. High-Temperature, Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to. Comply with ASTM C553, Type V.

H. Mineral Wool Blanket: Basalt volcanic rock-derived fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to in accordance with ASTM C447. Comply with ASTM C553.

I. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between and for jacketed and between and for unfaced in accordance with ASTM C411. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. High-Temperature, Glass-Fiber Board: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to in accordance with ASTM C411. Comply with ASTM C612, Type III, unfaced.

K. Mineral Wool Board: Basalt volcanic rock-derived fibers bonded with a thermosetting resin; suitable for maximum use temperature up to in accordance with ASTM C411. Comply with ASTM C612, Type III, unfaced.

2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. 2-layer warp for grease ducts rated as a shaft alternative per ASMT E2236
2. Zero clearance to combustible.
3. High-temperature fibrous thermal insulation blanket encapsulated in a fiberglass-reinforced aluminized polyester foil.
4. Density of 6 pcf and have a nominal 1.5” thickness.
5. Fiber blanket shall have a continuous use limit of 1832 F.
6. Blanket thermal resistance value (R-Value) at ambient temperature shall be minimum of 6.3 F-ft^2-hr/BTU.
7. Smoke developed Index and Flame Spread Index of the bare blanket, and of the foil encapsulated blanket shall be0/0.
8. The foil encapsulation shall be bonded to the core blanket material.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.5 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based, Interior Use: Suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, greater than at manufacturer's recommended dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials are compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Color: Aluminum.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 thick, 3/4 wide with wing seal.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
b. Spindle: Stainless steel, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
b. Spindle: Nylon, 0.106-inch diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
b. Spindle: Stainless steel, fully annealed, 0.106 inch diameter shank, length to suit depth of insulation indicated.
c. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016 inch thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal ¾-inch wide, stainless steel or Monel.

D. Wire: 0.080-inch stainless steel.

2.10 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum in accordance with ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents, unless otherwise approved by the engineer of record.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer’s recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3 inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

B. Comply with manufacturer's written installation instructions.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with ½-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover

insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with ½ inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18 foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2 laps at longitudinal seams and 3-inch wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Comply with manufacturer's written installation instructions.

B. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

C. Insulate duct access panels and doors to achieve same fire rating as duct.

D. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.7 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless steel jackets.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed outdoor air.
2. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral wool blanket, 1-1/2 inch thick and 0.75 lb/cu. ft. nominal density.

B. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral wool blanket, 1-1/2 inch thick and 0.75 lb/cu. ft. nominal density.

C. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.

END OF SECTION 230713

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Requirements:

1. Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraint devices and installation.
2. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports and seismic restraints are to withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in

SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7 Seismically brace duct hangers and supports in accordance with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems - OSHPD Edition."

1. Seismic Hazard Level (SHL):
2. Connection Level:

B. Seismic Performance: Ductwork to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 230548 "Vibration and Seismic Controls for HVAC."

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified".
2. Component Importance Factor:

C. Wind Performance: Ducts are to withstand the effects of wind determined in accordance with to ASCE/SEI 7 See Section 230548 "Vibration and Seismic Controls for HVAC."

D. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

F. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

G. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than , select joint types in accordance with Figure 2-1.
2. For ducts with longest side or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-

support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation:
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish is to be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

D. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating is to be applied to the exterior surface.
2. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound is to have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: White.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

E. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, ¼-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

B. Fibrous-Glass-Free, Natural-Fiber Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.

1. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg mean temperature when tested in accordance with ASTM C518.
2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick stainless steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of or greater.
7. Secure liner with mechanical fasteners from corners and at intervals not exceeding transversely; at from transverse joints and at intervals not exceeding longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal is to provide maximum leakage class of 3 cfm/100sq. ft at 1-inch wg and is to be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPE 1 COMMERCIAL KITCHEN GREASE HOOD EXHAUST DUCT

A. Install ducts in accordance with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operation"; SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; and SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines" unless otherwise indicated.

B. Install all ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

C. All joints are to be welded and are to be telescoping, bell, or flange joint as per NFPA 96.

D. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-inch wg and Lower: Seal Class A.
3. Unconditioned Space, Exhaust Ducts: Seal Class C.
4. Unconditioned Space, Return-Air Ducts: Seal Class B.
5. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-inch wg and Lower: Seal Class A.
6. Conditioned Space, Exhaust Ducts: Seal Class B.
7. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC."

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. See Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraint installation requirements.

3.7 DUCTWORK CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
    a. Ducts with a Pressure Class Higher Than 3-inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
    b. Supply Ducts with a Pressure Class of 3-inch wgor Higher: Test representative duct sections**,** selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
    c. Exhaust Ducts with a Pressure Class of 3 inch wgor Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.

5. Test for leaks before applying external insulation.
6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media is to not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:

1. Ducts Connected to Constant-Volume Units

    a. Pressure Class: Positive 3 inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 4.
    d. SMACNA Leakage Class for Round and Flat Oval: 2.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 3 inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular:
    d. SMACNA Leakage Class for Round and Flat Oval: 2.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

    a. Pressure Class: Negative 1 inch wg.
    b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 16.

d. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless steel sheet, No. 4 or No. 3 finish.
b. Concealed: Type 304, stainless steel sheet.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 3 in wg.
e. Airtight/watertight.

D. Intermediate Reinforcement:

1. Stainless Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

E. Liner:

1. Supply-Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Supply Fan Plenums: Fibrous glass, , 1 inch thick.

F. Elbow Configuration:

1. Rectangular Duct - Requirements for Different Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 fpm to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct Requirements for All Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
        2) Velocity 1000 fpm to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
        3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
        4) Radius-to Diameter Ratio: 1.5.

    b. Round Elbows, 12 inches and Smaller in Diameter: Stamped or pleated.
    c. Round Elbows, 14 inches and Larger in Diameter: Standing seam or Welded.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Conical spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 fpm to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

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SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Duct access panel assemblies.
8. Flexible connectors.
9. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 90A and NFPA 90B.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Performance:

1. Maximum Air Velocity: 1000 fpm.
2. Maximum System Pressure: 0.5 in wg.
3. AMCA Certification: Test and rate in accordance with AMCA 511.
4. Leakage:

a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.

C. Construction:

1. Frame:

a. Hat shaped.
b. Stainless steel with welded or mechanically attached corners and mounting flange.

2. Blades:

a. Multiple single-piece blades.
b. End pivoted, maximum 6 inch width, 0.025 inch thick, Type 304 stainless steel with sealed edges.

3. Blade Action: Parallel.

D. Blade Seals: Neoprene, mechanically locked.

E. Blade Axles:

1. Material: Stainless steel.
2. Diameter: 0.20 inch.

F. Tie Bars and Brackets: Aluminum.

G. Return Spring: Adjustable tension.

H. Bearings: Steel ball.

I. Damper Actuator - Electric:

1. Electric - 120 V ac.
2. UL 873 plenum rated.
3. Two position.

a. Sufficient motor torque to drive damper fully closed with adequate force to achieve required damper seal.
b. Minimum 90-degree drive rotation.

4. Clockwise or counterclockwise drive rotation as required for application.
5. Environmental Operating Range:

a. Temperature: Minus 25°F to plus 180°F.
b. Humidity: 5 to 95 percent relative humidity noncondensing.

6. Environmental Enclosure: NEMA 2.
7. Actuator to be factory mounted and provided with a single-point wiring connection.

J. Controllers, Electrical Devices, and Wiring:

1. Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
2. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Screen Mounting:
    a. Rear mounted in sleeve.
4. Screen Material: Aluminum.
5. Screen Type: Insect.
6. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Performance:
    a. Leakage Rating Class II: Leakage not exceeding static pressure.
2. Construction:
    a. Linkage out of airstream.
    b. Suitable for horizontal or vertical airflow applications.
3. Frames:
    a. Hat-shaped, 0.094 inch thick stainless steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Stainless steel; 0.064 inch thick.
5. Blade Axles: Stainless steel.
6. Bearings:
    a. Stainless steel sleeve.
    b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
7. Tie Bars and Brackets: Galvanized steel.
8. Locking device to hold damper blades in a fixed position without vibration.

B. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle, made of 3/32 inch thick zinc-plated steel, and a hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

A. General Requirements:

1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.

B. Performance:

1. AMCA Certification: Test and rate in accordance with AMCA 511.
2. Leakage:
    a. Class IA: Leakage shall not exceed 3 cfm/ sq. ft against 1-inch wg differential static pressure.
    b. Class I: Leakage shall not exceed 4cfm/sq. ft. against 1-inch wg differential static pressure.
    c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Pressure Drop: 0.05 in w.g. at 1500 fpm across a 24 by 24 inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25°F to 180°F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

C. Construction:

1. Linkage out of airstream.
2. Suitable for horizontal or vertical airflow applications.
3. Frames:
    a. Hat, U, or angle shaped.
    b. Stainless steel.
    c. Mitered and welded Interlocking, corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
    a. Multiple blade with maximum blade width of 6 inches.
    b. Parallel blade design.
    c. Stainless steel.
5. Blade Edging Seals:
    a. Replaceable PVC.
    b. Inflatable seal blade edging, or replaceable rubber seals.
6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: diameter; stainless steel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.
9. Bearings:

a. Stainless steel sleeve.
b. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.

D. Damper Actuator - Electric:

1. Electric - 120 V ac.
2. UL 873, plenum rated.
3. Two position.
   a. Sufficient motor torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
   b. Minimum 90-degree drive rotation.
4. Clockwise or counterclockwise drive rotation as required for application.
5. Environmental Operating Range:
   a. Temperature: Minus 40°F to plus 130°F.
   b. Humidity: 5 to 95 percent relative humidity noncondensing.
6. Environmental enclosure: NEMA 2.
7. Actuator to be factory mounted and provided with a single-point wiring connection.

E. Controllers, Electrical Devices, and Wiring:

1. Comply with requirements for electrical devices and connections specified in Division 26.
2. Electrical Connection: 115 V, single phase, 60 Hz**.**

2.5 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gauge and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

D. Vane Construction:

1. Single double wall.
2. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. 24-gauge-thick stainless steel door panel.
d. Vision panel.
e. Hinges and Latches: butt or piano hinge and cam latches.
f. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

a. 24-gauge thick aluminum frame.

3. Number of Hinges and Locks:

a. Access Doors Less Than 12 inches Square: No hinges and two sash locks.
b. Access Doors up to 18 inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 18 inches: Three hinges and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 inches: Four hinges and two compression latches with outside and inside handles.

2.8 DUCT ACCESS PANEL ASSEMBLIES

A. Access panels used in cooking applications:

1. Labeled compliant to NFPA 96 for grease duct access doors.
2. Labeled in accordance with UL 1978 by an NRTL.

B. Panel and Frame: Minimum thickness 16-gauge stainless steel.

C. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96, grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

E. Minimum Pressure Rating: positive or negative.

2.9 FLEXIBLE CONNECTORS

A. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Materials: Flame-retardant or noncombustible fabrics.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4 inch wide, 0.028 inch thick, galvanized sheet steel or 0.032 inch thick aluminum sheets. Provide metal compatible with connected ducts.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360lbf/inch in the filling.
3. Service Temperature: Minus 40 to Plus 200 deg F.
4.

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd.
2. Tensile Strength: 450 lbf/inch in the warp and 340 lfb/inch in the filling.
3. Service Temperature: Minus 40°F to plus 120°F.

H. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of movement at start and stop.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.11 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation:
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

D. Tie Rods: Galvanized steel, minimum diameter for lengths or less; minimum diameter for lengths longer than.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.

E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

F. Set dampers to fully open position before testing, adjusting, and balancing.

G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50 inches spacing.
8. Upstream and downstream from turning vanes.
9. For grease ducts, install at locations and spacing as required by NFPA 96.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 inches by 5 inches.
2. Two-Hand Access: 12 inches by 6 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Install duct test holes where required for testing and balancing purposes.

O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

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SECTION 233416 - CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backward-inclined centrifugal fans, including airfoil and curved blade fans.
2. Centrifugal roof upblast

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: For fans, accessories, and components, from manufacturer.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Unusual Service Conditions

1. Base fan-performance ratings on the following:

a. Ambient Temperature: 82 deg F dry bulb.
b. Altitude: 0 feet above sea level.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

D. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 BACKWARD-INCLINED CENTRIFUGAL FANS

A. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, direct-driven centrifugal fans, consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
2. Factory-installed and -wired disconnect switch.

B. Housings:

1. Housing Material: Stainless steel .
2. Housing Coating: Epoxy.
3. Housing Assembly: Sideplates continuously welded**.**
4. Formed panels to make curved-scroll housings with shaped cutoff.
5. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
6. Horizontally split, bolted-flange housing.
7. Spun inlet cone with flange.
8. Outlet flange.
9. Discharge Arrangement: Fan scroll housing is field rotatable to any of eight discharge positions. Provide fan with discharge positioned in proper direction to minimize connected duct turns.

C. Wheels:

1. Wheel Configuration: SWSI construction with a precision-spun curved inlet flange and a backplate fastened to shaft with setscrews. Wheels shall be statically and dynamically balanced, and nonoverloading.
2. Wheel and Blade Material: Aluminum.
    a. Spark-Resistant Construction: Classified according to AMCA 99, Section 8, Type B
3. Wheel and Blade Coating: Epoxy
4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
5. Backward-Inclined Airfoil Blades:
    a. Aerodynamic design.
    b. Heavy backplate.
    c. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.
6. Backward-Inclined Curved Blades:
    a. Curved design.
    b. Heavy backplate.
    c. Single-thickness blades continuously welded at tip flange and backplate.

D. Shafts:

1. Statically and dynamically balanced, and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

E. Bearings:

1. Prelubricated and Sealed Shaft Bearings:

   a. Self-aligning, pillow-block-type ball bearings.

2. Grease-Lubricated Shaft Bearings, Tapered Roller:

   a. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
   b. Extended Lubrication Lines: Extend lines to accessible location.

3. Grease-Lubricated Shaft Bearings, Ball or Roller:

   a. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
   b. Extended Lubrication Lines: Extend lines to accessible location.

F. Motor Enclosure: Totally enclosed, air over.

G. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Discharge Dampers: Assembly with parallelblades constructed of two plates formed around, and to, shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
5. Inlet Screens: Grid screen of same material as housing.
6. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
7. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
8. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.
9. Piezometer Ring: Piezometer ring mounted at fan inlet cone for airflow measurement.

2.3 CENTRIFUGAL VENTILATORS – ROOF UPBLAST

A. Configuration: Centrifugal roof upblast, kitchen

B. Housing: Spun-Aluminum discharge baffle to direct air upward, with rain and snow drains.

C. Fan Wheel: Alumnimum hub and wheel with backward inclide blades.

D. Direct Drive motor

E. Certification: High wind, seismic rated, Restaurant exhaust, California Energy Commission Title 20 Compliant/Exempt.

F. Provide with prefabricated kitchen exhaust curb. Galvanized steel, mitered and welded corners, ventilation openings on all sides to ventilate curb interstitial space. UL762 listed for grease-laden air.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

B. Where variable-frequency drives are indicated or scheduled, provide fan motor compatible with variable-frequency drive.

2.5 SOURCE QUALITY CONTROL

A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.

B. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.

C. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.

D. Operating Limits: Classify fans in accordance with AMCA 99, Section 14.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:

1. Install floor- or roof-mounted centrifugal fans on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
3. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Curb Support, Field Built-Up: Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," detail "Equipment Support Curb," number "SPF-9" (page 1409) and detail "Equipment Support Curb," number "SPF-9S" (page 1410). Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.

F. Curb Support, Prefabricated: Rail-type wood support provided by fan manufacturer.

G. Unit Support: Install centrifugal fans level on structural curbs. Coordinate with duct connections. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts**.**

H. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration-isolation and seismic-control devices.

1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC".
2. Comply with requirements in Section 230548.13 "Vibration Controls for HVAC."

I. Install units with clearances for service and maintenance.

J. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK AND PIPING CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

D. Install heat tracing on all drain piping subject to freezing temperature and as indicated on Drawings. Furnish and install heat tracing according to Section 230533 "Heat Tracing for HVAC Piping."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE:

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
4. Verify that cleaning and adjusting are complete.
5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
6. For belt-drive fans, disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
7. Adjust belt tension.
8. Adjust damper linkages for proper damper operation.
9. Verify lubrication for bearings and other moving parts.
10. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
11. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
12. Shut unit down and reconnect automatic temperature-control operators.
13. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Lubricate bearings.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Fans and components will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416

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SECTION 237423.16 - PACKAGED, ELECTRIC, OUTDOOR, HEATING-ONLY MAKEUP-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes outdoor, electric, heating-only, makeup air units, including the following components:

1. Casings.
2. Outdoor-air intake hood.
3. Roof curbs.
4. Fans, drives, and motors.
5. Air filtration.
6. Dampers.
7. Electric heater.
8. Unit control panel.
9. Controls.
10. Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each outdoor, indirect, gas-fired, heating-only, makeup air unit.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Sample Warranty: For manufacturer's warranty.

C. Seismic Qualification Data: Certificates, for outdoor, indirect, gas-fired, makeup air units, accessories, and components, from manufacturer.

D. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Startup service reports.

F. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For indirect, gas-fired, makeup air units to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of indirect, gas-fired heating and ventilating units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Entire Unit: Manufacturer's standard, but not less than 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of units and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Seismic Performance: Indoor, indirect gas-fired, heating and ventilating units shall withstand the effects of earthquake motions determined according to ASCE and SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

2.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
2. Casing Joints: Sheet metal screws or pop rivets, factory sealed with water-resistant sealant.
3. Makeup Air Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

B. Configuration: Horizontal unit with bottom discharge for roof-mounting installation.

C. Double-Wall Construction:

1. Outside Casing Wall: Galvanized steel, minimum 16 gauge thick, with manufacturer's Hi-Pro polyester 5,000 hr/slat spray rating under ASTM B117 testing conditions.
2. Inside Casing Wall:

a. Inside Casing, All Other Sections: Galvanized steel solid steel.

3. Floor Plate: Galvanized steel, minimum 18 gauge thick.
4. Casing Insulation:

a. Materials: Glass-fiber blanket.
b. Casing Panel R-Value: Minimum 3.1.
c. Insulation Thickness: 1 inch.
d. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.

5. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. Panels and Doors:

1. Panels:

a. Fabrication: Formed and reinforced, with same materials and insulation thickness as casing.
b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against airflow.
c. Gasket: Neoprene, applied around entire perimeters of panel frames.
d. Size: Large enough to allow unobstructed access for inspection and maintenance of unit's internal components.

2. Doors:

a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
b. Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against airflow. Provide safety latch retainers on doors so that doors do not open uncontrollably.
c. Gasket: Neoprene, applied around entire perimeters of panel frames.
d. Size: Large enough to allow unobstructed access for inspection and maintenance of unit's internal components.

3. Locations and Applications:

a. Fan Section: Inspection and access panels.
b. Access Section: Doors.
c. Electric Burner Section: Inspection and access panels.Damper Section: Inspection and access panels.
d. Filter Section: Inspection and access panels large enough to allow periodic removal and installation of filters.

2.3 OUTDOOR-AIR INTAKE HOOD

A. Type: Manufacturer's standard hood.

B. Materials: Match cabinet.

C. Bird Screen: Comply with requirements in ASHRAE 62.1.

D. Filter: 2” MERV 13 pleated disposable

E. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.4 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or Type II.
b. Thickness: 1 inch.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

C. Curb Height: 14 inches.

D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match unit, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

2.5 FANS, DRIVES, AND MOTORS

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

B. Fans: B, rated according to AMCA 210; galvanized steel; mounted on solid-steel shaft.

1. Shafts: With field-adjustable alignment.
2. Shaft Bearings: Heavy-duty permanently lubricated ball bearings with an L50 rated life of 100,000 hours according to ABMA 9.
3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
4. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
5. Shaft Lubrication Lines: Extended to a location outside the casing.
6. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch- wide by 0.028-inch-thick, galvanized-steel sheet.

a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

C. Drives: Factory-mounted Variable Frequency Drive, constant volume control. The VFD shall be programmed from the factory for a constant supply fan speed. This is to be adjusted for air balancing only and is not to be modulated.

D. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Maximum sizes as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Enclosure: ODP

4. Enclosure Materials: Cast iron.
5. Unusual Service Conditions:
    a. Ambient Temperature: 82.6 deg F.
    b. Altitude: 0 feet above sea level.
    c. High humidity.
6. Efficiency: Premium efficient as defined in NEMA MG 1.
7. NEMA Design
8. Motor Pulleys: Adjustable pitch.Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.

2.6 AIR FILTRATION

A. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."

B. Panel Filters:

1. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
4. Filter-Media Frame: Beverage board with perforated metal retainer, or metal grid, on outlet side.
5. MERV 13

C. Adhesive, Sustainability Projects: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.

2.7 DAMPERS

A. Outdoor- Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed or parallel-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg.

B. Electronic Damper Operators:

1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
3. Operator Motors:
    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
    c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring

mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
6. Size dampers for running torque calculated as follows:
    a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
    b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
    c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
    d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
    e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
    f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
7. Coupling: V-bolt and V-shaped, toothed cradle.
8. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
9. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
10. Power Requirements (Two-Position Spring Return): 24 V dc.
11. Temperature Rating: Minus 22 to plus 122 deg F.

2.8 ELECTRIC HEATER

A. Description: Factory assembled and wired; and complying with ANSI Z21.47 and with NFPA 54.

B. CSA Approval: Designed and certified by and bearing label of CSA.

C. Electric Heater: with coil coating for protection.

D. Control: SCR/VSCR modulating control

E. Safety Controls:

1. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
2. Control Transformer: 24 V ac.

2.9 UNIT CONTROL PANEL

A. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.

B. Control Panel: Surface-mounted remote panel, with engraved plastic cover and the following lights and switches:

1. On-off-auto fan switch.
2. Supply-fan operation indicating light.
3. Thermostat.

2.10 CONTROLS

A. Control Devices:

1. Remote Thermostat: Adjustable room thermostat with temperature readout.
2. Remote Setback Thermostat: Adjustable room thermostat without temperature readout.
3. Timers, Seven Day:

    a. Programming-switch timer with synchronous-timing motor and seven-day dial.
    b. Continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover.
    c. Multiple-switch trippers.

B. Fan Control, Interlocked: Fan to start automatically with exhaust fan(s) to which this heating and ventilating unit is associated for makeup air.

C. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.

2.11 ACCESSORIES

A. Electric heater with integral thermostat maintains a supply air temperature within 10 degrees of outside air.

B. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

C. Low-ambient kit using variable-speed condenser fans for operation down to 35 deg F .

D. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

E. Coil guards of painted, galvanized-steel wire.

F. Hail guards of galvanized steel, painted to match casing.

2.12 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine roughing-in ducts, and electrical systems to verify actual locations of piping and electrical connections before equipment installation.

B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems" and AHRI Guideline B. Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment.

C. Unit Support: Install unit level on structural steel supports. Coordinate roof penetrations and flashing with roof construction. Secure units to structural support with anchor bolts. Coordinate sizes and locations of steel supports with actual equipment provided.

1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

D. Install controls and equipment shipped by manufacturer for field installation.

3.2 DUCTWORK CONNECTIONS

A. Duct Connections: Connect supply and return ducts to indirect-fired heating and ventilating units with flexible duct connectors. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

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

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Units will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 DEMONSTRATION

A. Train owner's maintenance personnel to adjust, operate, and maintain heating and ventilating units.

END OF SECTION 237423.16

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SECTION 238236 - FINNED-TUBE RADIATION HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes electric radiation heaters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 ELECTRIC BASEBOARD RADIATION HEATERS (mounted high on wall)

A. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.

PART 3 - EXECUTION

3.1 BASEBOARD RADIATION HEATER INSTALLATION

A. Install units level and plumb.

B. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.

C. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.

3.2 CONNECTIONS

A. Ground electric finned-tube radiation heaters according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 238236

SECTION 238239.13 - CABINET UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cabinet unit heaters with centrifugal fans and hot-water coils.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Factory-assembled and -tested unit complying with AHRI 440.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

C. Seismic Performance: Cabinet unit heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified.

2.3 COIL SECTION INSULATION

A. Insulation Materials: ASTM C1071; surfaces exposed to airstream shall have aluminum-foil facing erosion-resistant coating to prevent erosion of glass fibers.

B. Insulation Materials: Comply with NFPA 90A or NFPA 90B. Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C534, Type II, except for density.

2.4 CABINETS

A. Material: Steel with factory prime coating, ready for field painting baked-enamel finish with manufacturer's standard paint, in color selected by Architect.

1. Horizontal Unit, Exposed Bottom Panels: Minimum thick galvanized sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
2. Recessed Flanges: Steel, finished to match cabinet.
3. Control Access Door: Key operated.
4. Base: Minimum thick steel, finished to match cabinet, high with leveling bolts.
5. Extended Piping Compartment: wide piping end pocket.
6. False Back: Minimum thick steel, finished to match cabinet.

2.5 CONTROLS

A. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

B. Basic Unit Controls:

1. Control voltage transformer.
2. Unit-mounted thermostat with the following features:

a. Heat-off switch.
b. Fan on-auto switch.

3. Unit-mounted temperature sensor.

C. Electrical Connection: Factory-wired motors and controls for a single field connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

B. Install cabinet unit heaters to comply with NFPA 90A.

C. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC." Section 230548.13 "Vibration Controls for HVAC."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

E. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Comply with safety requirements in UL 1995.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 238239.13

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SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 ELECTRICAL WIRING AND SAFETY DEVICE DELINEATION OF RESPONSIBILITIES

A. Unless otherwise indicated, all HVAC equipment motors and controls shall be furnished, set in place, and wired in accordance with the following schedule: MD = HVAC Division, ED = Electrical Division, TD = Temperature Control Division, I = Installer of equipment requiring electrical service.

B. Note: If Temperature Control Division is a subcontract to the HVAC Contractor, both MD and TD shall fall under the responsibility of MD. If no Temperature Control Contractor is under contract, MD shall assume all Temperature Control responsibilities.

C. Coordinate with Division 22 and Division 23 contractor within 30 days after award of contract to obtain complete summary list of all HVAC and Plumbing equipment requiring electric power. This list shall summarize equipment power loads/ line voltage control requirements, quantities, and location of equipment and connection points. The list shall clearly identify

specific HVAC, Plumbing, and controls equipment that shall operate on emergency or standby power.

	Furnished Under	Set In Place or Mounted Under	Power Wired & Connected Under	Control Wired & Connected Under
1. Other Equipment Motors/Starters	I	I	ED	I
2. Plumbing Equipment Motors	PD	PD	ED	TD
3. HVAC Equipment Motors	MD	MD	ED	TD
4. HVAC Magnetic Motor Starters, VFD's	MD	MD	ED	TD
5. Control Wiring Regardless of Voltage	TD	TD	TD See footnote 1	TD
6. Control Components: Control Relays, Thermostats, Control Transformers, EP, PE Switches	TD	TD	TD See footnote 1	TD
7. Temperature Control Panels, Time Clocks, Controllers	TD	TD	TD See footnote 1	TD
8. Valve and Damper Motors and Actuators	TD	TD	TD See footnote 1	TD
9. Control Valves, Solenoid Valves	TD	MD	--	TD
10. Control Dampers Integral with a Fan Unit	MD	MD	--	--
11. Control Dampers (duct mounted)	TD	MD	--	TD
12. Thermowells in Piping	TD	MD	--	--
13. Fire Protection (Exterior Horn & Light)	FD	ED	ED	ED
14. Fire Protection (Tamper & Flow Switch)	FD	FD	ED	ED See footnote 3
15. Smoke Duct Detectors (including relays)	ED See footnote 3	MD See footnote 3	ED See footnote 4	ED See footnote 3
16. Fire and Smoke Dampers	MD	MD	ED	ED See footnote 2
17. Pushbutton Stations and Pilot Lights	MD	MD	ED	TD See footnote 4
18. Manual Operating Switches	MD	MD	ED	-- See footnote 5
19. Multi-speed Switches (not integral with Equipment served)	MD	MD	ED	-- See footnote 5
20. Fused and Unfused Disconnect Switches & Thermal Overload Switches	ED See footnote 6	ED See footnote 6	ED	--
21. Contactors	ED	ED	ED	ED
22. Temporary Heating Connection	MD	MD	ED	TD
23. Water Heater Controls	PD	PD	TD See footnote 1	TD
24. Boiler Controls, Boiler Burner Control Panels Internally Wired	MD	MD	TD See footnote 1	TD
25. Remote Disconnect Switches for Boiler (Heating, Domestic HW & Pool Heat) Controls per ASME-CSD-1.	TD	TD See footnote 7	TD See footnote 8	TD

1. Footnote 1: It is the intention of this specification for all conduit and wiring which connects to control equipment or provides controls to HVAC equipment to be provided by the Temperature Control Contractor. Other portions of the specification which may be in conflict with this concept shall be brought to the attention of the engineer for clarification prior to bidding the project. The ED shall provide line voltage wiring conduit and junction boxes for the express purpose of temperature controls. It shall be the responsibility of the Temperature Control Contractor to coordinate the location of the junction boxes (if not otherwise shown on the Electrical Drawings) and to utilize these junction boxes for temperature control wiring. The Temperature Control Contractor shall extend line and/or low voltage wiring from junction boxes to all HVAC and control components which require control wiring.
2. Footnote 2: Wiring from the fire alarm electrical contacts to fire alarm system control panel by ED; all HVAC/Plumbing equipment control function wiring by TD. ED to coordinate locations of electrical contact with MD. MD to coordinate locations of duct smoke detectors with ED.
3. Footnote 3: MD shall assist in locating the detectors, but ED shall verify that the installation meets the manufacturer's installation guidelines, and is responsible for correctly ordering the smoke detectors. MD shall mount the detectors in a manner directed by ED according to manufacturer's recommendation. If the detector is used for operation of a smoke/fire damper, the control wiring will be by ED. If the unit is used for fan shutdown, the fire alarm functions will be by ED and the wiring to the starter or VFD for a direct shutdown will be by MD, typically by the TD. Any signal required for the sequence of operation shall be coordinated between MD and ED, with ED providing a point of connection and MD responsible for the remainder of the installation.
4. Footnote 4: For connection to auxiliary contacts if required.
5. Footnote 5: Device is used in the power wiring circuit to the equipment. Control functions do not exist.
6. Footnote 6: Unless furnished with equipment.
7. Footnote 7: A manually operated remote shutdown switch(es) shall be located just outside the boiler room door and marked for easy identification. Consideration should be given to the type and location of the switch to safeguard against tampering. If the boiler room door is on the building exterior, the switch should be located just inside the door. If there is more than one door to the boiler room, there should be a switch located at each door. The emergency shutdown switch shall be wired to the boiler safety circuit relay and shall disconnect all power to the boiler safety circuit.
8. Footnote 8: TD shall provide 24V to emergency power off switches

1.6 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
    b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co.
    d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

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

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 05 00

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
2. Division 26 Section "Undercarpet Electrical Power Cables" for flat cables for undercarpet installations.
3. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

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.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. Copper Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Minimum wire size shall be #12AWG.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

G. Feeders have been sized to limit voltage drop to 2%. The contractor shall increase branch circuit conductors, as required, to limit voltage drop in each branch circuit to 3%.

H. Where Metal-clad cable, Type MC is utilized for branch circuit runs, it shall not be allowed to enter into panelboard enclosures.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

D. All wiring connections made at or below grade shall be waterproof with UL listed waterproof connectors.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular

space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.
   2. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

   1. Test wells.
   2. Ground rods.
   3. Ground rings.
   4. Grounding arrangements and connections for separately derived systems.
   5. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

   1. Instructions for periodic testing and inspection of grounding features at ground rings and grounding connections for separately derived systems based on NETA MTS and NFPA 70B.

      a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
      b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

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.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Stainless steel; 3/4 inch by10 feet (19 mm by 3 m) in diameter.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.

4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches (600 mm) from building foundation.

J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.5 FIELD QUALITY CONTROL

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

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

C. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.

3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Contracting Officer promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. GRC: Galvanized rigid conduit.

F. IMC: Intermediate metal conduit.

G. LFMC: Liquidtight flexible metal conduit.

H. LFNC: Liquidtight flexible nonmetallic conduit.

I. NBR: Acrylonitrile-butadiene rubber.

J. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

F. EMT: ANSI C80.3.

G. FMC: Zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Set-screw for conduits less than 2-inches. Compression type for conduits 2-inches or larger.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

C. Description: Comply with UL 2024; flexible type, approved for general-use installation.

2.4 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with

captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Butler Manufacturing Company; Walker Division.
b. Enduro Systems, Inc.; Composite Products Division.
c. Hubbell Incorporated; Wiring Device-Kellems Division.
d. Lamson & Sessions; Carlon Electrical Products.
e. Panduit Corp.
f. Walker Systems, Inc.; Wiremold Company (The).
g. Wiremold Company (The); Electrical Sales Division.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.

7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

I. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. CDR Systems Corporation.
d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. Christy Concrete Products.
d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Carson Industries LLC.
b. Christy Concrete Products.
c. Nordic Fiberglass, Inc.

2.9 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.10 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless Steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.11 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: PVC (UV resistant) coated Galvanized Rigid Conduit
2. Concealed Conduit, Aboveground: PVC (UV resistant) coated GRC
3. Underground Conduit: RNC, Type 80-PVC, direct buried. Underground bends are to utilize PVC Coated Rigid Steel prefabricated sections. Vertical underground conduit (risers) shall be PVC Coated Rigid Steel.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4x.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: PVC coated GRC
2. Exposed, Not Subject to Severe Physical Damage: PVC coated GRC
3. Exposed and Subject to Severe Physical Damage: PVC coated GRC. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: PVC coated GRC
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: PVC coated GRC
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: PVC coated GRC
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

G. Conduits in a crawl space, if not supported from structure, shall be buried in at least 6" of soil.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

    a. Outdoor Locations Not Exposed to Direct Sunlight: [125 deg F (70 deg C)] temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: [155 deg F (86 deg C)] temperature change.
    c. Indoor Spaces: Connected with the Outdoors without Physical Separation: [125 deg F (70 deg C)] temperature change.
    d. Attics: [135 deg F (75 deg C)] temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

S. Where installed in fire-rated partitions, apply firestop putty pads or similar fire rated products on or around outlet boxes as required to maintain the fire rating of the partition.

T. Support outlet boxes and switch boxes from two (2) adjacent studs. Outlet boxes designed to attach to one metal stud and be "sandwiched" between the front and back layers of Gypsum Wallboard are not allowed.

U. Back-to-back outlets in commons walls are not permitted. Outlet boxes shall be separated by at least one stud wherever possible. In cases of outlet boxes of adjacent rooms in the same stud cavity at the same height, provide a layer of expandable spray foam insulation around each box in that cavity. There must be a minimum of a 1" horizontal separation space between boxes of adjacent rooms. If this condition occurs in a fire rated wall, provide a 1 hour fire rated putty pad to cover the back of outlets of one side of the partition. Other junction box installations on fire rated walls shall comply with UL requirements.

V. Where shown adjacent to receptacles, telephone, data and cable TV outlets shall be located no further than 6” on center from the center of the receptacle. Cable television outlets and telephone outlets shall be combined in a single faceplate in resident units.

W. Contractor shall not install conductors or cables in a building that is not completely waterproofed, unless the conductors or cable is rated for wet location installations.

X. Route circuit homeruns down corridors, above accessible ceilings.

Y. Minimum burial depth for underground conduit shall be 24”.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.6 kg), minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.

1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior concrete and masonry primer.
2) Finish Coats: Exterior semigloss acrylic enamel.

2. Exterior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Exterior semigloss acrylic enamel.

3. Exterior Ferrous Metal:

    a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

        1) Primer: Exterior ferrous-metal primer.
        2) Finish Coats: Exterior semigloss alkyd enamel.

4. Exterior Zinc-Coated Metal (except Raceways):

    a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

        1) Primer: Exterior zinc-coated metal primer.
        2) Finish Coats: Exterior semigloss alkyd enamel.

5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):

    a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

        1) Primer: Interior concrete and masonry primer.
        2) Finish Coats: Interior semigloss alkyd enamel.

6. Interior Concrete Unit Masonry:

    a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.

        1) Block Filler: Concrete unit masonry block filler.
        2) Finish Coats: Interior semigloss acrylic enamel.

7. Interior Gypsum Board:

    a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

        1) Primer: Interior gypsum board primer.
        2) Finish Coats: Interior semigloss acrylic enamel.

8. Interior Ferrous Metal:

    a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

        1) Primer: Interior ferrous-metal primer.
        2) Finish Coats: Interior semigloss acrylic enamel.

9. Interior Zinc-Coated Metal (except Raceways):

    a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

        1) Primer: Interior zinc-coated metal primer.
        2) Finish Coats: Interior semigloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.
3. Combined Fire Alarm and Security System: Red and blue.
4. Security System: Blue and yellow.
5. Mechanical and Electrical Supervisory System: Green and blue.
6. Telecommunication System: Green and yellow.
7. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

I. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label 4 inches (100 mm) high.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Disconnect Means for Equipment: Indicate the equipment being served and the panelboard and circuit numbers that are being utilized.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Electrical switchgear and switchboards.
d. Transformers.
e. Electrical substations.
f. Emergency system boxes and enclosures.
g. Motor-control centers.
h. Disconnect switches.
i. Enclosed circuit breakers.
j. Motor starters.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Battery inverter units.
p. Battery racks.

q. Power-generating units.
r. Voice and data cable terminal equipment.
s. Master clock and program equipment.
t. Intercommunication and call system master and staff stations.
u. Television/audio components, racks, and controls.
v. Fire-alarm control panel and annunciators.
w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
x. Monitoring and control equipment.
y. Uninterruptible power supply equipment.
z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 to 14 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 26 05 53

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Indoor occupancy sensors.

B. Related Sections include the following:
1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

C. Related Sections include the following:

1. Division 13 Section "Lighting Controls" for low-voltage, manual and programmable lighting control systems.
2. Division 16 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.
3. Division 16 Section "Dimming Controls" for architectural dimming system equipment.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Cooper Lighting Controls.
3. Grasslin Controls Corporation; a GE Industrial Systems Company.
4. Intermatic, Inc.
5. Leviton Mfg. Company Inc.
6. Lightolier Controls; a Genlyte Company.
7. Lithonia Lighting; Acuity Lighting Group, Inc.
8. Paragon Electric Co.; Invensys Climate Controls.
9. Square D; Schneider Electric.
10. TORK.
11. Touch-Plate, Inc.
12. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: **SPST**.
2. Contact Rating: **20-A ballast load, 120/240-V ac**.
3. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week **and an annual holiday schedule that overrides the weekly operation on holidays**.
4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
5. Astronomic Time: **All** channels.
6. Battery Backup: For schedules and time clock.

2.2 INDOOR OCCUPANCY SENSORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. RAB Lighting, Inc.
6. Sensor Switch, Inc.
7. TORK.
8. Watt Stopper (The).
9. Cooper Lighting Controls.

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.3 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. **18** AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. **14** AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 09 23

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.
8. Mimic bus.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.

4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Qualification Data: For qualified **testing agency**.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions. All electrical rooms (both normal and

emergency) and generator rooms have been laid out using dimensional data from specific manufacturers. Submit ¼" scale drawings of each normal and emergency electrical room (including satellite electrical rooms) or generator room with the actual sizes of all equipment (including fire alarm panels, lighting control panels, contactors, etc.) shown appropriately. For ease of installation, the Contractor may be permitted to rearrange the equipment in each room, provided that all NEC required clearances are maintained and wall space allotted for future equipment is maximized. All submittals must be approved prior to beginning any rough-in work.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and connect factory-installed space heaters to temporary electrical service to prevent condensation.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.7 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
    b. Altitude: Not exceeding 6600 feet (2000 m).

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by NPS or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Contracting Officer no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Contracting Officer written permission.
4. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

C. Nominal System Voltage: 208Y/120 V.

D. Main-Bus Continuous: 600 A.

E. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

F. Outdoor Enclosures: Type 4X.

1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
2. Enclosure: Downward, rearward sloping roof; bolt-on rear covers for each section, with provisions for padlocking.
3. Doors: Personnel door at each end of aisle, minimum width of 30 inches (762 mm) opening outwards; with panic hardware and provisions for cylinder lock.
4. Accessories: Fluorescent lighting fixtures, ceiling mounted; wired to a three-way light switch at each end of aisle; ground-fault circuit interrupter (GFCI) duplex receptacle; emergency battery pack lighting fixture installed on wall of aisle midway between personnel doors.
5. Walk-in Aisle Heating and Ventilating:

a. Factory-installed electric unit heater(s), wall or ceiling mounted, with integral thermostat and disconnect and with capacities to maintain switchboard interior temperature of 40 deg F (5 deg C) with outside design temperature of 104 deg F (40 deg C).
b. Factory-installed exhaust fan with capacities to maintain switchboard interior temperature of 100 deg F (38 deg C) with outside design temperature of 23 deg F (minus 5 deg C).
c. Ventilating openings **complete with replaceable fiberglass air filters**.
d. Thermostat: Single stage; wired to control heat and exhaust fan.

6. Power for Space Heaters, Ventilation, Lighting, and Receptacle: Include a control-power transformer within the switchboard. Supply voltage shall be 120/208V ac.
7. Power for space heaters, ventilation, lighting, and receptacle provided by a remote source.

G. Barriers: Between adjacent switchboard sections.

H. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

I. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in switchboard.

J. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

K. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks.

L. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

M. Removable, Hinged Rear Doors and Compartment Covers: Secured by standard bolts, for access to rear interior of switchboard.

N. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

O. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

P. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, with tin-plated aluminum or copper feeder circuit-breaker line connections.

2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
3. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity tin-plated, high-strength, electrical-grade aluminum alloy.
4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with **mechanical** connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
5. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with **mechanical** connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
6. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
7. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with **mechanical** connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with **mechanical** connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
9. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

Q. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

R. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

S. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: **Mechanical** style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: **Integrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    f. Communication Capability: **Circuit-breaker-mounted** communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
    g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **55** percent of rated voltage.
    h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    i. Auxiliary Contacts: **One SPDT switch** with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
    j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.3 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, **single** secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; **wound** type; **single** secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

2.4 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

D. Overhead Circuit-Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.

E. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

2.6 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.

1. Nameplate: At least 0.032-inch- (0.813-mm-) thick anodized aluminum, located at eye level on front cover of the switchboard incoming service section.

B. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

C. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

D. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 12-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "**Cast-in-Place Concrete**."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges. Circuit breaker manufacturer shall perform a circuit breaker coordination study to ensure that all adjustable-trip circuit breakers are selectively coordinated with down-stream breakers so that fault conditions are interrupted by local overcurrent devices as much as possible and nuisance-tripping of up-stream breakers is minimized. Manufacturer shall furnish the specific settings of all adjustable-trip circuit breakers to the Contractor and the Contractor shall include this information with the switchboard and circuit breaker submittals

H. Install spare-fuse cabinet.

I. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Division 26 Section "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Comply with requirements for terminating cable trays specified in Division 26 Section "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems." Provide engraved nameplates for each switch and/or circuit breaker in the switchboard.

D. Provide a ½ scale of the “as-built” electrical one-line diagram, with all laminated and mounted under 0.125” thick clear acrylic with a satin finish aluminum frame. All “as-built” comments shall be incorporated into AutoCAD and plotted for this use. Locate drawing adjacent to main switchboard.

3.5 FIELD QUALITY CONTROL

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

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train NPS’s maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 26 24 13

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to **SEI/ASCE 7**.

   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event**."

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards. Coordinate room names and/or numbers to be used in panel schedules with final naming and numbering conventions.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to **NECA 407** / **NEMA PB 1**.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding **23 deg F (minus 5 deg C)** to plus 104 deg F (plus 40 deg C).
    b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Contracting Officer no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Contracting Officer’s written permission.
3. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: **Flush- and surface**-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, **Type 1**.
b. Outdoor Locations: NEMA 250, **Type 4X (316 SS)**.
c. Other Wet or Damp Indoor Locations: NEMA 250, **Type 4X (316 SS)**

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

a. Panels and Trim: **Steel** and **galvanized steel**, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: **Same finish as panels and trim**.
c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in **transparent card holder**.

C. Incoming Mains Location: **Top and bottom**.

D. Phase, Neutral, and Ground Buses:

1. Material: **Hard-drawn copper, 98 percent conductivity**.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: **Hard-drawn copper, 98 percent conductivity**.
2. Main and Neutral Lugs: **Compression** type.
3. Ground Lugs and Bus-Configured Terminators: **Compression** type.
4. Feed-Through Lugs: **Compression** type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: **Compression** type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: **Compression** type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: bolt on circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with **interrupting capacity** to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: **Compression** style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: **Integrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Communication Capability: **Circuit-breaker-mounted** communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
    f. Shunt Trip: **120**-V trip coil energized from separate circuit, set to trip at **75** percent of rated voltage.
    g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage **without intentional** time delay.
    h. Auxiliary Contacts: **One SPDT switch** with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    i. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    k. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    l. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in **on or off** position.
    n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.4 PANELBOARD SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Current Technology; a subsidiary of Danahar Corporation.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Liebert Corporation.
5. Siemens Energy & Automation, Inc.
6. Square D; a brand of Schneider Electric.

B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:

a. LED indicator lights for power and protection status.
b. Audible alarm, with silencing switch, to indicate when protection has failed.
c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to **NECA 407**.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to **NECA 407**.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "**Cast-in-Place Concrete**."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim [**90 inches (2286 mm)**] above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

K. Provide labels in accordance with the National Electrical Code on each panel that contains series rated equipment.

L. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

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

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges **as indicated**.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 262713 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes equipment for utility company's electricity metering.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:

1. Electricity-metering equipment.

B. Shop Drawings for Electricity-Metering Equipment:

1. Dimensioned plans and sections or elevation layouts.
2. Wiring Diagrams: Power, signal, and control wiring specific to this Project. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
3. Mounting and anchoring devices recommended by manufacturer to resist seismic forces specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Manufacturer Seismic Qualification Certification for Electricity-Metering Equipment: Submit certification that equipment components and their mounting and anchorage provisions have been designed to remain in place without separation of any parts or loosening of factory-made connections when subjected to the seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculations.
2. Detailed description of equipment mounting and anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For electricity-metering equipment to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. 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 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center as specified in NECA 400.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Contracting Officer no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Contracting Officer's written permission.

1.7 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power and communication services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

B. Meter Sockets: Comply with requirements of electrical power utility company.

C. Modular Meter Center: Factory-coordinated assembly of a main service disconnect device, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.

1. Available Manufacturers:

a. Cutler-Hammer; Eaton Corporation.
b. General Electric Company; Electrical Distribution & Control Div.
c. Siemens Energy & Automation, Inc.
d. Square D; Schneider Electric.

2. Housing: NEMA 250, Type 4X enclosure.

a. Structural strength of the housing, its anchorage and component attachment provisions, and anchorage devices recommended for anchoring the housing in place shall be adequate to prevent separation of equipment and its components from their installed positions during a seismic event as defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

3. Minimum Short-Circuit Rating: 65,000 amperes symmetrical at rated voltage.
4. Main Disconnect Device: Circuit breaker.
5. Tenant Feeder Circuit Breakers: Series-combination-rated molded case units, rated to protect circuit breakers in downstream tenant and house loadcenters and panelboards that have 10,000-A interrupting capacity.

a. Identification: Complying with Division 26 Section "Identification for Electrical Systems" with legend identifying tenant's address.
b. Physical Protection: Tamper resistant, with hasp for padlock.

6. Meter Socket: Type as approved by utility company, with rating coordinated with indicated tenant feeder circuit rating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to NECA 400 switchboard installation requirements.

3.2 FIELD QUALITY CONTROL

A. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.

1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
2. Turn off circuits supplied by metered feeder and secure them in off condition.
3. Run test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use test load placement and setting that ensures continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at test load connection. Record test results.
5. Repair or replace deficient or malfunctioning metering equipment, or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

END OF SECTION 26 27 13

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Pendant cord-connector devices.
4. Wall-box motion sensors.
5. Snap switches and wall-box dimmers.
6. Communications outlets.
7. Cord and plug sets.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

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.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).

b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.8 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable switch; with single-pole or three-way switching. Comply with UL 1472.

2.9 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 6111 for 120 V, 6117 for 277 V.
    b. Hubbell; WS1277.
    c. Leviton; ODS 10-ID.

d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; AT120 for 120 V, AT277 for 277 V.
b. Leviton; ODS 15-ID.

3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATD1600WRP.
b. Leviton; ODW12-MRW.
c. Watt Stopper (The); DT-200.

3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. Wide-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP120HBRP.
b. Leviton; ODWHB-IRW.
c. Pass & Seymour; HS1001.
d. Watt Stopper (The); CX-100-3.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

2.10 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 3560-6.
    b. Leviton; 40649.

3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6a. Comply with UL 1863.

2.11 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch- (1-mm-) thick.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.12 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: White, or as selected by Contracting Officer, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Devices are shown on plan documents diagrammatically. The exact location of devices shall be coordinated with the final architectural drawings and approved vendor shop drawings prior to rough-in. Exact device location shall allow for coordinated, pre-drywall relocation, within a 10ft radius at no charge to the Owner.

2. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
3. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
4. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
5. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
2. Half-switched receptacles shall have the ground pin at the top and the lower outlet shall be switched.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
4. Provide dimmers rated for the appropriate load type and wattage. Follow manufacturer's instructions for grouping devices in multi-gang boxes. De-rate dimmers as necessary.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

J. Where surface raceways will not accept conduit sizes larger than ½", it shall be acceptable to feed the raceway with ½" conduit back to the nearest junction box. The length of this conduit shall not exceed 20'.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar

problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Perform the following field tests and inspections on the wall-box occupancy sensors and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

END OF SECTION 26 27 26

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes lightning protection system for the following:

1. Ordinary structures: Class I: Up to 75ft in height.

1.3 DEFINITIONS

A. LPI: Lightning Protection Institute.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
2. Include raceway locations needed for the installation of conductors.
3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
4. Include roof attachment details, coordinated with roof installation.
5. Calculations required by NFPA 780 for bonding of metal bodies.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lightning protection cabling attachments to roofing systems and accessories.
2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For lightning protection system to include in maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations. Comply with requirements of Section 017839 "Project Record Documents."
b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

B. Completion Certificate:

1. LPI Master Certificate.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: LPI Master Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following

1. Advanced Lightning Technology, Ltd
2. East Coast Lightning Equipment, Inc.
3. Independent Protection Company, Inc.
4. Harger Lightning and Grounding, Inc.
5. Approved Equal.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for Class I buildings.

B. UL Lightning Protection Standard: Comply with UL 96A requirements for Class I buildings.

C. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.3 MATERIALS

A. Air Terminals:

1. Stainless Steel unless otherwise indicated. Aluminum components shall be utilized in locations where components are mounted to aluminum surfaces to avoid galvanic corrosion of dissimilar materials.
2. 1/2-inch (12.7-mm) diameter by 18 inches (450 mm) long.
3. Pointed tip.
4. Integral base support.

B. Air Terminal Bracing:

1. Stainless steel.
2. 1/4-inch (6-mm) diameter rod.

C. Class 1 Main Conductors:

1. Stranded Copper: 57,400 circular mils in diameter.

D. Secondary Conductors:

1. Stranded Copper: 26,240 circular mils in diameter.

E. Ground Loop Conductor: Stranded copper.

F. Ground Rods:

1. Material: Solid copper.
2. Diameter: 5/8 inch (16 mm).
3. Rods shall be not less than 120 inches (3050 mm) long.

G. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems in a neat and workmanlike manner according to UL 96A and NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches (203 mm) in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet (60 m) of building. Comply with requirements for concealed installations in UL 96A and concealed systems in NFPA 780.

1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
2. Install conduit where necessary to comply with conductor concealment requirements.
3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: bolted connectors, exothermic weld, high compression, crimp.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Perform inspections as required to obtain a UL Master Label for system.
2. Perform inspections to obtain an LPI certification.

B. Prepare test and inspection reports and certificates.

END OF SECTION 26 41 13

SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Requirements:
1. Section 262416 "Panelboards" for factory-installed SPDs.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 1.

B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1

1. SPDs with the following features and accessories:

a. Integral disconnect switch.

b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
e. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 700 V for 208Y/120 V.
3. Line to Line: 1000 V for 208Y/120 V.

F. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Line to Line: 1000 V.

G. SCCR: Equal or exceed 200 kA.

H. Inominal Rating: 20 kA.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 13

SECTION 270010 - SUPPLEMENTAL REQUIREMENTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements generally applicable to the Work specified in Division 27.
   a. Work specified in Division 27 may be applicable to, or in coordination with, trades other than division 27. It is the contractor's responsibility to coordinate with other trades to define and complete the scope of work.

B. Related Requirements:

1. Refer to the division 26 specifications for further information regarding:
   a. Abbreviations, acronyms, definitions, and additional coordination drawing submittal requirements.
   b. For seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
2. Refer to the specifications below:
   a. 270526 – Grounding And Bonding For Communication Systems
   b. 270528 – Pathways For Communication Systems
   c. 270529 – Hangers And Supports For Communication Systems
   d. 270544 - Sleeves And Sleeve Seals For Communication Pathways And Cabling
   e. 270553 - Identification For Communication Systems
   f. 271116 - Communications Racks, Frames, And Enclosures
   g. 271513 - Communications Copper Horizontal Cabling
   h. 280010 - Supplemental Requirements For Electronic Safety And Security

1.2 REFERENCES

A. Abbreviations and Acronyms for Communications:

1. LAN: Local area network.
2. PoE: Power over Ethernet.
3. POTS: Plain old telephone service. See "public switched telephone network."
4. TCP/IP: Transmission control protocol/Internet protocol.
5. WAN: Wide area network.

B. Definitions for Communications:

1. Calling Party Control (CPC): A momentary break in phone line loop current, which is used to signal voicemail and other automated telephone company services that distant party has hung up.
2. Private Branch Exchange (PBX): Analog telephone switch that routes calls internal to a business or organization so a direct external line for each phone is unnecessary.

3. Public Switched Telephone Network (PSTN): Analog telephone technology that uses twisted-pair cables from a telephone-provider central office for the transmission medium. PSTN refers to the telephone network; POTS refers to the individual subscriber line.
4. Remote Office Phone System (ROPS): VoIP system that allows phones for a business or organization located anywhere in the world with internet connectivity to behave similar to phones connected to a PBX.
5. Ringer Equivalence Number (REN): The loading effect of a single traditional telephone ringing circuit. TIA-968 defines REN 1 as an impedance of 7000 Ω at 20 Hz (Type A ringer) or 8000 Ω from 15 Hz to 68 Hz (Type B ringer). The sum of the RENs for all devices on a subscriber line circuit may not exceed the maximum permitted REN for the subscriber line.
6. Voice over Internet Protocol (VoIP): Digital telephone packet technology that uses the internet for its transmission medium.

1.3 COORDINATION

A. The Technology drawings and specifications provide the scope and requirements of construction applicable to multiple trades and systems. These systems are inclusive of, but not limited to, structured cabling, low voltage, access control, and other such systems. Each system requires the coordination of multiple contracting trades and disciplines. It is the responsibility of each contractor to review all technology scope and to coordinate with other disciplines.

B. Contractor shall coordinate with all other trades prior to construction, at minimum, contractor shall coordinate with the general, electrical, security, other low voltage contractors. It is the contractor's responsibility to ensure all other contractor trades are aware and knowledgeable of the system requirements and associated responsibilities as defined in these construction documents.

C. Contractor shall always maintain a working set of the construction documents in field (These may be printed or virtual). These documents shall always represent the latest information as well as capture all changes to final constructed solution(s). Any cost associated with an unaccepted installation, and subsequent reinstallation, due to the wrong documentation reference is the sole responsibility of the contractor and shall not be a cost transferred to Contracting Officer. At a minimum, the working set of construction documents shall include:
   1. The latest version of construction documents
   2. All changes associates with change orders, RFIs, Addenda, email, and/or other such documentation
   3. All field coordinated changes and/or changes to be captured in as-built drawings.

D. For any and all discrepancies, contractor shall provide written notification to Contracting Officer, or other, dependent on division 1 and contracted communication protocols, prior to commencement of work and/or procurement of material.

E. Interruption of Existing Telephone, Internet, CATV, Cellular, or other such Service: Do not interrupt service to facilities occupied by End user or others unless permitted under the following conditions:

   1. Notify Construction Manager and Contracting Officer no fewer than 20 business days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Contracting Officer's written permission.

1.4 PREINSTALLATION MEETINGS

A. Communications Preconstruction Conference: Schedule conference with Contracting Officer not later than 10 business days after notice to proceed. Agenda topics include, but are not limited to, the following:

1. Installation schedule for communications systems.
2. Value analysis proposals and requests for substitution of communications equipment.
3. Utility services work coordination and monitoring service requests.
4. Commissioning activities.
5. Sustainability activities.

1.5 ACTION SUBMITTALS

A. Coordination Drawings: Submit multidiscipline coordination drawings depicting communications equipment, devices, cabling, conduit, and duct banks in accordance with Division 01 and Division 27 Specification Sections.
   1. Coordination Drawings for Structural Supports: Show coordination of structural supports for equipment and devices, including restraints and bracing for control of seismic and wind loads, with other systems, equipment, and structural supports in the vicinity.
   2. Coordination Drawings for Ceiling Areas: Reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
      a. Size and location of access panels.
      b. Elevation, size, and route of cable tray.
      c. Elevation, size, and route of conduit.
      d. Elevation and size of wall-mounted and ceiling-mounted equipment.
      e. Communications devices.
      f. Speakers.
      g. Security devices.
   3. Coordination Drawings for Cable Tray Routing: Reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
      a. Elevation, size, and route of cable trays.
      b. Relationships between components and adjacent structural, electrical, and mechanical elements.
      c. Vertical and horizontal offsets and transitions.
      d. Elevation and size of sleeves for wall, ceiling, and floor cable penetrations.
      e. Elevation of ceilings and size of ceiling tiles.
      f. Locations of access panels on ceilings.
      g. Locations where cable tray crosses or parallels sprinkler piping.
      h. Locations where cable tray crosses plumbing piping.
      i. Locations where cable tray crosses or parallels ductwork.
      j. Locations of access panels on ductwork.
      k. Locations where cable tray crosses conduit.

l. Indicate clear dimension between cable tray and walls or obstructions that are closer than 3 ft. (1 m).
m. Highlight locations where cable tray is greater than 1 ft. (.3 m) above ceilings. Explain how personnel access will be accommodated for cable tray maintenance.

4. Coordination Drawings for Conduit Routing: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   a. Structural members in paths of conduit groups with common supports.
   b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
5. Coordination Drawings for Duct Banks: Signed and sealed by qualified professional engineer.
   a. Show duct profiles and coordination with other utilities and underground structures.
   b. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

1.6 INFORMATIONAL SUBMITTALS

A. Installation Schedule for Communications Systems: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for installation of communications work to Contracting Officer including, but not limited to, milestone dates for the following activities:

1. Submission of specified coordination drawings.
2. Submission of action submittals specified in Division 27.
3. Orders placed for major equipment.
4. Arrival of major equipment on-site.
5. Preinstallation meetings specified in Division 27.
6. Telephone, CATV, Cellular, and internet service outages.
7. Telephone, CATV, Cellular, and internet service inspection and activation.
8. Mockup reviews.
9. Closing of walls and ceilings containing communications Work.
10. System startup, testing, and commissioning activities for communications equipment.
11. System startup, testing, and commissioning activities for Work specified in other divisions that depends on Work specified in Division 27.
12. Requests for special inspections.
13. Requests for inspections by authorities having jurisdiction.

B. Certificates:
1. Seismic-Load Performance Certificates: Provide special certification as indicated in Paragraph 13.2.2 "Special Certification Requirements for Designated Seismic Systems" of ASCE/SEI 7-16 for designated seismic-load systems identified on Drawings or in the Specifications.

   a. Include the following information:

      1) Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2) Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4) Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
5) Provide equipment manufacturer's written certification for each designated active electrical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction.
6) Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by qualified structural professional engineer.

2. Wind-Load Performance Certificates: Provide special certification for designated wind-load systems and components identified on Drawings or in the Specifications.

a. Include the following information:

1) Provide equipment manufacturer's written certification for each designated system and component, stating that it will remain in place and operable following the design wind event and comply with requirements of authorities having jurisdiction.
2) Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:

a. Communications Room Equipment and Fittings
b. Structured Cabling System

2. Include the following information:

a. Manufacturer's operating specifications.
b. User's guides for software and hardware.
c. Schedule of maintenance material items recommended to be stored at Project site.
d. Detailed instructions covering operation under both normal and abnormal conditions.
e. Manufacturer's instructions for setting field-adjustable components.
f. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.

B. Software and Firmware Operational Documentation: Provide software and firmware operational documentation, including the following:

1. Software operating and upgrade manuals.
2. Names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.
5. Testing and adjusting of panic and emergency power features.
6. Provide the program Software Backup username and password for approved online or cloud solution.
7. Provide to Contracting Officer the upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.

1.8 QUALIFICATIONS

A. Communications Design Professional: Design professional possessing active qualifications specified in Section 014000 "Quality Requirements" and the following:

1. Expertise in design of communications infrastructure and distribution equipment.
2. BICSI Registered Communications Distribution Designer (RCDD) certification.

B. Communications Cable Installer: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" and the following:

1. Training and manufacturer certification to install, splice, and terminate communications cabling.
2. Installation Supervisor: BICSI Technician (TECH) certification.
3. Copper Installers: 30 percent of on-site employees possess BICSI Copper Installer 2 (INSTC) certification. Remaining employees possess BICSI Installer 1 (INST1) certification.
4. Fiber Installers: 30 percent of on-site employees possess BICSI Optical Fiber Installer 2 (INSTF) certification. Remaining employees possess BICSI Installer 1 (INST1) certification.

C. Communications Testing Agency: Entity possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

1. On-site communications testing supervisor must have BICSI Technician (TECH)] certification and documented training, and be experienced with testing communications equipment in accordance with BICSI and ANSI/TIA testing standards.

1.9 FIELD CONDITIONS

A. Modeling, analysis, product selection, installation, and quality control for Work specified in Division 27 must comply with requirements specified in Section 260011 "Facility Performance Requirements for Electrical."

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR COMMUNICATIONS EQUIPMENT

A. Substitution requests for communications equipment will be entertained under the following conditions:

1. Substitution requests may be submitted for consideration prior to the Communications Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for End user throughout life of facility.
2. Contractor is responsible for sequencing and scheduling equipment procurement. After the Communications Preconstruction Conference, insufficient lead time for equipment delivery will not be considered a valid reason for substitution.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Immediately upon initial (1st day) arrival to site, contractor shall coordinate with General Contractor for all site and project specific information. Contractor shall adhere to all General Contractor requirements throughout duration of project.

2. Prior to commencement of work, contractor shall reference and/or inspect the following conditions:
   a. All safety and security protocols specific to site construction.
   b. The most current version of construction documents as specified in section 1.3.C herein.
   c. The most updated/recent version of project and installation schedule(s).
   d. All coordinated work previously completed and coordinated work that is uncompleted but scheduled for prior completion.
   e. Current construction conditions affecting scope of work.

3. For any and all questions, concerns, coordination, or other project specific information, especially those affecting schedule, quality of work, or system acceptance, contractor shall inform Contracting Officer in as timely a manner as possible.

B. Preinstallation Testing:

1. It is the contractor's responsibility to ensure that all material and equipment is tested for acceptance pursuant to the manufacturer's specifications and parameters prior to installation.

2. All material and equipment shall be tested for acceptance immediately upon being received by contractor.

a. If material and/or equipment is received off-site, material and/or equipment shall be retested and confirmed to be acceptable upon arrival on-site.

3. Any material and/or equipment that fails testing procedure and is unacceptable for installation shall be noted and communicated to manufacturer. Dependent upon scope and breadth of failures, contractor shall coordinate required replacement material and maintain installation schedule. If failures affect the installation schedule and/or project schedule, contractor shall inform the Contracting Officer.

3.2 PREPARATION

A. Protection of In-Place Conditions:

1. Contractor shall always maintain a neat and orderly workspace while on site. The workspace shall not interfere with, or in any other form, disallow other trades to complete their scope of work or maintain proper schedule of work.

2. All tools, material, equipment, trash, etc., shall be maintained to be always neat and orderly while on site.

3. All material and equipment that has been installed shall be protected in place. It is the contractor's responsibility to ensure all installed equipment is protected in place through means of protective coverings, enclosed/restricted spaces, and coordination with other trades. The items of note include, but are not limited to:
   a. Capping/Taping the open ends of unused conduit and open backboxes while protecting pull string.
   b. Covering of all active equipment and termination components to ensure any openings, ports, or other such component orifices are protected from elements such as water, dust, and construction debris and/or material.
   c. Isolation of telecommunication rooms and equipment from general construction whenever possible to minimize water, dust, and construction debris and/or material.
   d. Protection of active equipment from tampering, especially pre-configured or recently configured.
   e. Proper bonding and grounding of all equipment immediately upon installation.

3.3 INSTALLATION OF COMMUNICATIONS WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' instructions, contractors shall complete scope of work in a neat and workmanlike manner and comply with NFPA 70, NECA NEIS 1, and BICSI N1 for installation of Work specified in Division 27. Consult Contracting Officer for resolution of conflicting requirements.

B. For all Work specified in Division 27, contractor shall provide a complete and functional (turnkey) system. Coordination with Contracting Officer and other trades may be required. Reference the Responsibility Matrix on Technology sheets for information per each system.

3.4 SYSTEM STARTUP

A. Commissioning Activities:

1. Contractor shall reference and adhere to manufacturer's startup/activation requirements for commissioning.

2. Commissioning effort shall ensure that system is complete and operational prior to final testing, system turnover and substantial completion.

3.5 FIELD QUALITY CONTROL

A. Administrant for Communications Equipment, Systems, and Material Tests and Inspections:
1. Contractor shall administer and perform tests and inspections.

2. Contractor may utilize assistance of factory-authorized service representative, or a third-party certified testing authority, at no cost to Contracting Officer.

3.6 CLEANING

A. Waste Management:

1. Proper disposal and on-site management of all waste material, packaging, and other such extra items not scheduled for install is required. It is the contractor's responsibility to ensure all waste management procedures and protocols are observed and practiced with regards to any and all waste accumulated.

2. Prior to initial (1st day) arrival on site, contractor shall coordinate with General Contractor for current site conditions, rules, regulations, and requirements regarding the accumulation and disposal of waste.

3. The requirements below are in addition to General Contractor defined site requirements, not in lieu of, and shall not supersede any site requirements. Any discrepancy between the below and the site requirements shall be communicated to General Contractor for further clarification.
   a. All trash or waste accumulated shall be properly disposed of at the end of each day.
   b. Any material deemed hazardous must be disposed of immediately. Disposal of material shall be communicated to, and coordinated with, General Contractor.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration:

1. Contractor shall coordinate with Contracting Officer and general contractor to schedule time and attendance for a contractor provided demonstration of the operability of the following systems and equipment:
   a. Telecommunication Equipment Room

b. Structured Cabling System (Horizontal and Backbone) and Infrastructure
   1) Copper

2. It is acceptable for contractor to engage sub-contractors, manufacturer representatives, and/or third parties, to conduct demonstration. Any engagement of such shall be at no cost to Contracting Officer.

3. At Contracting Officer's request, Contractor shall record demonstration(s) or allow Contracting Officer to record demonstration(s). Any contractor provided recording shall be at no extra cost to Contracting Officer.

B. Training:

1. Train end user's maintenance personnel on any system and/or equipment defined herein. Training shall be administered by contractor(s) over a duration as specified below. This shall include the training of how to adjust, operate, update, and maintain the system(s) as specified in:
   a. Section 271116 "Communications Rack, Frames, and Enclosures"
      1) 1 hour at minimum

   At Contracting Officer's request, Contractor shall record training session(s) or allow Contracting Officer to record session(s). Any contractor provided recording shall be at no extra cost to Contracting Officer.

END OF SECTION 27 00 10

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Selection and installation of communications busbars.
2. Selection and installation of communications bonding conductors.
3. Selection of signal reference grids.
4. Installation of grounding and bonding for towers and antennas.

B. Related Requirements:

1. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. In addition to information listed herein, contractor shall reference the below standards:
   a. ANSI/TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises.
   b. ANSI/NECA/BICSI 607 - BICSI Standard for Telecommunication Grounding and Bonding, Planning and Installation Methods for Commercial Building
   c. NFPA 70 (NEC)

1.2 DEFINITIONS

A. BBC: Backbone bonding conductor, for connecting multiple SBBs serving the same floor.

B. PBB: Primary bonding busbar, located in main distribution frame room, ideally near electrical service entrance.

C. RBB: Rack bonding busbar, located in equipment cabinets and racks.

D. SBB: Secondary bonding busbar, located in intermediate distribution frame rooms.

E. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.

F. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device at electrical service entrance.

G. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.

H. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. Manufacturer and Part number

a. Shall be highlighted to indicate version of equipment to be utilized when multiple models/variations of product are present on documentation.

2. For communications equipment room signal reference grid.
3. Include plans, elevations, sections, details, and attachments to other work.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:

1. Installing wire connector on conductor.
2. Recommended torque values.

1.5 CLOSEOUT SUBMITTALS

A. Record Documentation: Project record documents in accordance with Section 017839 "Project Record Documents" must include locations of PBB and SBBs, and routing of TBC, TBBs, and BBCs.

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

1. Chatsworth Products, Inc. (CPI)
2. Panduit
3. Middle Atlantic
4. Commscope
5. Erico

2.2 SELECTION OF COMMUNICATIONS BUSBARS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Must be UL listed and have a hole pattern configuration in line with recommendations of ANSI/BICSI and ANSI/TIA 607 standards.

C. Must be made of copper, or copper alloy having a minimum of 95% conductivity as specified by the International Annealed Copper Standard (IACS).

D. PBB:
1. Dimensions: 1/4 inch thick by 4 inch high by 20 inch wide (6.3 mm thick by 100 mm high by 500 mm wide)
2. Stand-Off Distance: 4 inch (100 mm)

E. SBB:

1. Dimensions: 1/4 inch thick by 4 inch high by 12 inch wide (6.3 mm thick by 100 mm high by 300 mm wide)
2. Stand-Off Distance: 2 inch (50 mm) at minimum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of TBC connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of TBC only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF COMMUNICATIONS BONDING CONDUCTORS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Communications Busbar Connections:

1. Unless otherwise specified, contractor shall refer to information below for sizing of grounding conductor cables:
   a. For any application(s) where the conductor length does not exceed 100 feet (30.5m), a minimum of 6AWG conductor is acceptable.
   b. For any application(s) where the conductor length is greater than 100 feet (30.5m):
      1) Determine the size of the grounding electrode conductor (GEC).
      2) Increase the size of the bonding conductor by one trade size for every 100 feet (30.5m) of length.

C. Cable Tray Connections:

1. Cable Tray Equipment Grounding Conductor: 6 AWG.

2. Cable Tray Bonding Jumper: If not supplied by cable manufacturer, provide bonding jumper not smaller than 6 AWG and not longer than 12 inch (300 mm). If jumper is wire, it must be terminated with lug having at least one hole and a standard-length barrel for single crimp. If jumper is flexible braid, it must be terminated with two-hole ferrule. Attach with bonding screw or connector provided by cable tray manufacturer.

D. Underground Connections: Not smaller than 2 AWG. Provide welded connectors, except bolted connectors may be used in handholes or manholes and as otherwise indicated on Drawings.

3.3 INSTALLATION OF BONDING FOR COMMUNICATIONS

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Bonding of Communications: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with BICSI N3.
2. Consult contracting officer for resolution of conflicting requirements.

C. Special Techniques:

1. Busbars:

a. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 18 inch (450 mm) above finished floor unless otherwise indicated.
b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

2. Conductors:

a. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
b. Assemble wire connector to conductor, complying with manufacturer's published instructions and as follows:

1) Use crimping tool and die specific to connector.
2) Pretwist conductor.
3) Apply antioxidant compound to bolted and compression connections.

c. Install in straightest and shortest route between origination and termination point, and no longer than required. Bend radius must not be smaller than 10 times diameter of conductor. No single bend may exceed 90 degrees.
d. Install without splices.
e. Support conductors at not more than 36 inch (900 mm) intervals.
f. Outside telecommunications rooms, install conductors in metric designator 21 (trade size 3/4) PVC-80 conduit until conduit enters telecommunications room. Install bonding conductors in EMT-A or EMT-SS when routed through plenum. Do not install bonding conductors in EMT-S unless otherwise indicated on Drawings.

1) If bonding conductor must be installed in EMT-S or other ferrous metallic raceway, bond conductor to raceway using grounding bushing that complies with Section 270528 "Pathways for Communications Systems," and bond both ends of raceway to SBB.

3. Provide TBC and terminate ends to PBB and intersystem bonding termination device at electrical service entrance in accordance with Section 250.94, "Bonding for Communication Systems," of NFPA 70.
4. Busbar Interconnections: Bond SBBs to PBB with TBBs. If more than one TBB is installed, bond TBBs together. Install BBCs where required by TIA-607.
5. Structural Steel: Where structural steel of steel frame building is readily accessible within room or space, bond each SBB and PBB to vertical steel of building frame.
6. Communications Enclosures: Bond metallic enclosures of telecommunications equipment with UBCs to nearest SBB or PBB.
7. Equipment Racks: Bond metallic components of enclosures to RBB using UBCs. Provide top-mounted RBB if not provided by enclosure or rack manufacturer. Bond RBB to SBB with TEBC. Power connection must comply with NFPA 70; equipment grounding conductor in power cord of cord- and plug-connected equipment must be considered supplemental to bonding requirements in this Section.
8. Shielded Cable: Bond shield of shielded cable to SBB in communications rooms and spaces. Comply with TIA-568.1 and TIA-568.2 when grounding shielded balanced twisted-pair cables.
9. Primary Protector: Bond to PBB with insulated bonding conductor.
10. Electrical Power Panelboards: Where electrical panelboards for communications equipment are located in same room or space, bond each ground bar of panelboard to SBB.
11. Cable Trays: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
12. Conduits/Sleeves: Bond all conduit and/or sleeve pathways to nearest SBB or PBB.
13. Ladder Racks/Runways: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
14. Access Floors: Bond metal parts of access floors to SBB.

3.4 IDENTIFICATION

A. Comply with Section 270553 "Identification for Communications Systems."

B. Labels must be preprinted or computer-printed type.

1. Label PBB(s) with "ts-PBB," where "ts" is telecommunications space identifier for location of PBB.
2. Label SBB(s) with "ts-SBB," where "ts" is telecommunications space identifier for location of SBB.
3. Label TBC, TBBs, and BBCs at attachment points with legend: "WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.5 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Prior to acceptance testing, contractor shall preform initial testing and inspection checks to ensure system is in proper order. All insufficiencies or failures in system should be discovered and mitigated prior to acceptance testing procedure.
2. Coordinate with Contracting Officer and the authority having jurisdiction (AHJ) prior to system acceptance testing for any witness requirements.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench according to manufacturer's published instructions.
2. Test bonding connections of system using AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing PBB or SBB, using process recommended by BICSI N1. Conduct tests with facility in operation.

    a. Measure resistance between PBB and electrical service intersystem termination point. Maximum acceptable value is 100 mΩ.

        1) If measured resistance from electrical service equipment to ground exceeds 1 Ω, notify contracting officer and include recommendations to reduce resistance to ground.

    b. Measure resistance between SBBs and PBB. Maximum acceptable value is 100 mΩ.

3. Test for ground loop currents using digital clamp-on ammeter, with full scale not more than 10 A, displaying current in increments of 0.01 A at accuracy of plus or minus 2.0 percent.

    a. With grounding infrastructure completed and communications system electronics operating, measure current in bonding conductors connected to PBB and to SBBs. Maximum acceptable AC current level is 1.00 A.

C. Nonconforming Work:

1. Communications bonding will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Collect, assemble, and submit test and inspection reports.

3.6 PROTECTION

A. After installation, protect busbars and conductors from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Contracting Officer.

END OF SECTION 27 05 26

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Innerduct pathways
4. J-Hooks and Slings.
5. Boxes, enclosures, and cabinets.
6. Polymer-concrete handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid conduit.

C. IMC: Intermediate metal conduit.

D. RTRC: Reinforced thermosetting resin conduit.

E. EMT: Electrical Metallic Tubing.

1.4 ACTION SUBMITTALS

A. Product data for the following:

1. Surface pathways
2. Wireways and fittings.
3. Boxes, enclosures, and cabinets.
4. Underground handholes and boxes.

B. Sustainable Design Submittals:

C. Shop Drawings including plans, elevations, sections, and attachment details for:
   1. custom enclosures
   2. custom cabinets
   3. underground handholes and lids
   4. pullboxes

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

   1. Structural members in paths of pathway groups with common supports.
   2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
   3. Underground ducts, piping, and structures in location of underground enclosures and handholes.

B. Seismic Qualification Data: Provide seismic bracing for all pathway racks, enclosures, cabinets, equipment racks, and their mounting provisions, including those for internal components, from manufacturer.

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
   4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Allied Tube & Conduit
   4. Anamet Electrical, Inc.
   5. Electri-Flex Co.

6. Manhattan/CDT/Cole-Flex
7. Maverick Tube Corporation
8. O-Z Gedney
9. Wheatland Tube Company

C. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
2. Comply with TIA-569-D.

D. GRC: Comply with ANSI C80.1 and UL 6.

E. ARC: Comply with ANSI C80.5 and UL 6A.

F. IMC: Comply with ANSI C80.6 and UL 1242.

G. PVC-Coated Steel Conduit: PVC-coated GRC.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

H. EMT: Comply with ANSI C80.3 and UL 797.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
2. Fittings for EMT:

a. Material: Steel
b. Type: compression

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.

B. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International
7. Electri-Flex Co.
8. Lamson & Sessions
9. Carlon Electrical Products
10. Manhattan/CDT/Cole-Flex
11. RACO
12. Thomas & Betts Corpoation

C. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Comply with TIA-569-D.

D. RNC: Type EPC-40-PVC & Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. Rigid HDPE: Comply with UL 651A.

F. Continuous HDPE: Comply with UL 651A.

G. RTRC: Comply with UL 2515A and NEMA TC 14.

H. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.

I. Solvents and Adhesives: As recommended by, and in respect to, each manufacturer listed above.

2.3 INNERDUCT PATHWAYS

A. Description: Comply with UL 2024; flexible-type pathway, able to be installed into existing conduit or routed independently in plenum environment, and approved for plenum and general-use (dependent on specific product) installation unless otherwise indicated.

B. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:
1. Carlon
2. Maxcell: Premise
3. Dura-Line

C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with TIA-569-D.

2.4 J-HOOKS & SLINGS

A. Description: Prefabricated cable supports for telecommunications cable.

B. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:
   1. Cablofil
   2. Arlington
   3. Legrand
   4. Erico: CADDY
   5. Eaton: Cooper B-Line
   6. Panduit

C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with TIA-569-D.

E. Steel / Stainless steel / Nylon

F. J-shape / Sling Type

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Description: Enclosures for communications.

B. General Requirements for Boxes, Enclosures, and Cabinets:

   1. Comply with TIA-569-D.
   2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
   3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
   4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)]
      a. Refer to drawing notes, details, and other such information for the use of any other size/type of device box (commonly referred to as backbox also)
   5. Gangable boxes are prohibited.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Metal Floor Boxes:

   1. Material: sheet metal
   2. Type: Semi-adjustable
   3. Shape: Rectangular.

4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes:

1. Any use of nonmetallic floor boxes is prohibited without prior approval by Contracting Officer, unless otherwise noted.

G. Conduit Bodies: A pull box that is manufactured to facilitate a change in the direction of the pathway at 90-degree increments, while also adhering to ANSI/TIA 568 and BICSI standards for cabling and pathway bend radius requirements. It is acceptable to use this device to optimize pathway routing near or at a penetration only.
1. For all locations where a conduit body may be installed, contractor shall submit the location and specification of device to be used to Contracting Officer prior to installation for approval.
2. Device shall have lid and gasket to protect cabling from exposure to elements and other such debris.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250 (Type indicated below) with continuous-hinge cover with flush latch unless otherwise indicated. Shall be manufactured of steel, finished inside and out with manufacturer's standard enamel.
1. The following NEMA 250 enclosure types shall be utilized for each scenario at a minimum, it is the contractor’s responsibility to increase the enclosure type rating as required for each installation.
    a. Interior to Telecommunication Room - Type 2 at minimum
    b. Interior to building, outside of Telecommunication Room - Type 12 at minimum
    c. Exterior Environment - Type 4 at minimum
    d. Any environment where corrosion, moisture, chemical, or other such hazardous or deteriorating substances may come in direct contact - Type 4x at minimum

K. Cabinets:

1. NEMA 250 (Type indicated below) galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
    a. The following NEMA 250 cabinet types shall be utilized for each scenario at a minimum, it is the contractor’s responsibility to increase the cabinet type rating as required for each installation.
        1) Interior to Telecommunication Room - Type 2 at minimum
        2) Interior to building, outside of Telecommunication Room - Type 12 at minimum
        3) Exterior Environment - Type 4 at minimum
        4) Any environment where corrosion, moisture, chemical, or other such hazardous or deteriorating substances may come in direct contact - Type 4x at minimum
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 POLYMER-CONCRETE HANDHOLES

A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.

B. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:
1. OldCastle Infrastructure

C. General Requirements for Polymer Concrete Handholes:

1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
3. Comply with TIA-569-D.

D. Configuration: Designed for flush burial with open bottom unless otherwise indicated.

E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
2. Cover Legend: Molded lettering, ["COMMUNICATIONS"].
   a. Coordinate with Contracting Officer prior to procurement of cover to ensure labeling/lettering is acceptable. Contractor shall provide alternate labeling/lettering per Contracting Officer’s request.
3. Cover Rating: Tier 15 rating unless otherwise noted

F. Handholes a minimum of 30 Inches Wide, 36 Inches Long, and 24 inches Deep (760 mm Wide, 910 mm Long, and 600 mm Deep) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.
1. Refer to drawings and schedules for more information.
2. Installed handhole size and installation parameters shall be in accordance with BICSI standards, existing and new conditions, and future growth.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: PVC coated GRC
2. Concealed Conduit, Aboveground: PVC coated GRC
3. Underground Conduit, direct buried in non-traffic area: Type EPC-40-PVC
4. Underground Conduit, direct buried in traffic area: Type EPC-80-PVC
5. Underground Conduit, concrete encased in traffic area: Type EPC-80-PVC
6. Boxes and Enclosures, Aboveground: NEMA 250, Type 4 and/or Type 4X as previously indicated.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: PVC coated GRC
2. Exposed, Not Subject to Severe Physical Damage: PVC coated GRC
3. Exposed and Subject to Severe Physical Damage: PVC coated GRC. Pathway locations include the following:
    a. Loading dock
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units
4. Concealed in Ceilings and Interior Walls and Partitions: PVC coated GRC
5. Damp, Wet, and/or Caustic Locations (Natatorium, high humidity areas, chemical storage, etc.): PVC coated GRC
    a. This does not include submerged areas and/or pathways.
6. Boxes and Enclosures: NEMA 250, Type 4X.

C. Minimum Pathway Size: 1-inch (25-mm) trade size for copper and aluminum cables, and 1 inch (25 mm) for optical-fiber cables.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. All conduit fittings that facilitate a change in pathway direction (such as a 90-degree bend) shall be:
    a. For conduits with an internal diameter of 2 inches or less, a sweeping bend with a bend radius greater than 6 times the pathway diameter, or
    b. For conduits with an internal diameter greater than 2 inches, a sweeping bend with a bend radius greater than 10 times the pathway diameter, or

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.

E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.

F. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

G. Complete pathway installation before starting conductor installation.

H. Arrange stub-ups so curved portions of bends are not visible above finished slab.

I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.

J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches (300 mm) of enclosures to which attached.

L. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
3. Arrange pathways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Contracting Officer for each specific location.

M. Stub-ups to Above Recessed Ceilings:
1. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

Q. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.

R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.

S. Cut conduit perpendicular to the length. For conduits of 2-inch (50-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

T. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

U. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 1-Inch (25-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

V. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a

blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.

W. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

X. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F (55 deg C), and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations: 125 deg F (70 deg C) temperature change.
    b. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    c. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches (150 mm) of slack.

4. The lowest point of the cables shall be no less than 6 inches (150 mm) adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
5. Space hooks no more than 5 feet (1.5 m) and no less than 2 feet (0.6 m) o.c., with distances between hooks alternating so not to allow electro-magnetic induction formation from consistent spacing.
6. Provide a hook at each change in direction.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

CC. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

FF. Set metal floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe of less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up throughout length of elbow.
    a. Material of elbow shall be consistent with the pathway installed.

5. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."
6. Coordinate with civil, structural, other trades with underground routing, and Contracting Officer for trenching locations and project specific requirements. If specifications listed above are not included in project documents, coordinate with Contracting Officer.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes with bottom below frost line, at least 24 inches below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 27 05 28

SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems for communication raceways.
2. Aluminum slotted support systems for communication raceways.
3. Conduit and cable support devices.
4. Support for conductors in vertical conduit.
5. Structural steel for fabricated supports and restraints.
6. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
7. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 270548 "Seismic Controls for Communications Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for communications hangers and support systems.

1. Trapeze hangers. Include product data for components.
2. Steel slotted-channel systems.
3. Aluminum slotted-channel systems.
4. Nonmetallic slotted-channel systems.
5. Equipment supports.
6. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Ductwork, piping, fittings, and supports.
3. Structural members to which hangers and supports will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Projectors and Projector Screens

B. Seismic Qualification Data: Certificates, for hangers and supports for communications equipment and systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Stainless Steel, Type 304
3. Channel Dimensions: Selected for applicable load criteria.

B. Aluminum Slotted Support Systems: Extruded aluminum channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Channel Material: 6063-T6 aluminum alloy.
3. Fittings and Accessories Material: 5052-H32 aluminum alloy.
4. Channel Dimensions: Selected for applicable load criteria.

C. Conduit and Cable Support Devices: Steel clamps, hangers, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored communications conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M,Grade A325 (Grade A325M).
6. Toggle Bolts: Stainless steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101.
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by]NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

B. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Use approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Use expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated-driven threaded studs, provided with lock washers and nuts, may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69]
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, enclosures, pull and junction boxes, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

C. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor communications materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

END OF SECTION 27 05 29

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manufactured Sleeve Seal Systems.
2. Conduit or Field Fabricated sleeves.
3. Sealants and Devices

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURED SLEEVE SEAL SYSTEM

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable. Shall be an engineered, re-enterable cable pathway that is specifically manufactured for facilitating a floor, ceiling, or wall penetration. The device shall match or exceed the fire-rating of the penetrated material, at minimum.

1. Sealing Elements: Self-sealing intumescent material

B. Pathway shall be able to be retrofitted to existing cable and penetration and shall be able to be removed from existing cabling, without cutting or splicing existing cables.

C. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

1. Hilti Inc.
2. Legrand
3. Specified Technologies Inc. (STI)

D. It is acceptable to utilize grommet type sleeves (typically allowing a single cable or small cable bundle through penetration), round type sleeves, and square type sleeves. Number of cables per rated penetration shall be in accordance with manufacturer.

2.2 CONDUIT OR FIELD FABRICATED SLEEVES

A. Pipe Sleeves, PVC:

1. Description: ASTM D1785, Schedule 40

B. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Description: Galvanized-steel sheet; thickness not less than 0.0239-inch (0.6-mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.3 SEALANTS AND DEVICES

A. Description: Products and material that have been tested for specific fire resistance, smoke, or acoustical rated construction, conforming to penetrating item type, filling annular space between cable and pathway, and filling the space between pathway and penetration.

1. Sealants - Single component latex formulations that, upon cure, do not re-emulsify during exposure to moisture.
2. Putty - Intumescent, non-hardening, water-resistant putties containing no solvents, inorganic fibers or silicone compounds.
3. Pillows - Re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES, SEALANTS, AND DEVICES THROUGH NON-FIRE-RATED BARRIERS

A. Comply with NECA 1.

B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

    a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
    b. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless sleeve seal system is to be installed or seismic criteria require different clearance.
4. Install sleeves for wall penetrations. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 6 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

D. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations:

1. For new construction, install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
2. For existing wall, install steel pipe sleeves through core drill penetration. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF SLEEVES, SEALANTS, AND DEVICES THROUGH RATED BARRIERS

A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

B. Install conduits and cable with no crossings within the sleeve.

C. Fill opening around conduits and cables with sealant without leaving voids.

D. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 27 05 44

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Underground-line warning tape.
2. Signs.
3. Bands and tubes.
4. Cable ties.
5. Miscellaneous identification products.
6. Labels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for communications identification products.

B. Identification Schedule:

1. Outlets: Scaled drawings indicating location and proposed designation.
2. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation.
3. Racks: Scaled drawings indicating location and proposed designation.
4. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-B.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
c. As required by authorities having jurisdiction.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE"

C. Tag, Detectable:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Width: 3 inches (75 mm).
3. Overall Thickness: 5 mils (0.125 mm).
4. Foil Core Thickness: 0.35 mil (0.00889 mm).
5. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
6. Tensile according to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

2.5 SIGNS

A. Laminated-Acrylic or Melamine-Plastic Signs:

1. Engraved legend.
2. Thickness:

    a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
    b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
    c. Engraved legend with white letters on a dark gray background.
    d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 CABLE TIES

A. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
3. Provide label 6 inches (150 mm) from cable end.

I. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

J. Underground-Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

K. Cable Ties: General purpose, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

1. System legends shall be as follows:

a. Network/Voice
b. Security
1) For Surveillance, Access Control, and/or Intrusion

D. Faceplates/Surface Mount Box:
1. Label individual faceplate with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the format shown:
a. [Cable Origination Room #] : [Outlet #]

2. Label individual ports with self-adhesive labels. Place label above each port. Each port label shall be composed of the following, in the format shown:
a. [Outlet Port #]

E. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels. Each shall be labeled sequentially, beginning with the device closest to the wall.
a. [Rack #]

2. Patch Panels: Label each individual patch panel in room sequentially, starting at the top of rack and working down, with self-adhesive labels. Patch panel numbering shall restart at one at each rack. Each patch panel label shall be composed of the following, in the format shown:

a. [Patch Panel #]

3. Patch Panel Port: Label each port with a self-adhesive label, place label directly above port in designated area. Each port shall be composed of the following, in the format shown:
   a. [Cable Termination Room #] : [Outlet #] : [Outlet Port #]

F. Backbone Cables:
   1. Label each cable within 6 inches of strand/conductor breakout with a vinyl-wraparound label indicating the location of the far or other end of the backbone cable. Each label shall be composed of the following, in the format shown:
      a. [Room Number of other end of cable] : [Patching Device] : [Patching Device #]
      b. Patching Device Legend:
         1) Fiber Patch Panel
         2) Copper Patch Panel
         3) 110-Block

G. Horizontal Cables: Label each cable within 6 inches of termination with a vinyl-wraparound label. Label shall match the port label as referenced above.

   1. For cables terminated at patch panel:
      a. Refer to label specified at Patch Panel Port
   2. For cables terminated at faceplate/surface mount box:
      a. Refer to label specified at faceplate/surface mount box

H. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.

I. Instructional Signs: Self-adhesive labels.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Laminated-acrylic or melamine-plastic sign

   1. Apply to exterior of door, cover, or other access.

END OF SECTION 27 05 53

SECTION 271116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backboards.
2. 19-inch equipment racks.
3. Open Rack equipment racks.
4. Power Distribution Unit (PDU)
5. Grounding.
6. Labeling.

B. Related Requirements:

1. Section 270526 "Grounding And Bonding For Telecommunications Equipment"
2. Section 270536 "Cable Trays For Communications Systems"
3. Section 271513 "Communications Copper Horizontal Cabling"

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. LAN: Local area network.

D. RCDD: Registered communications distribution designer.

E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

F. TGB: Telecommunications grounding bus bar.

G. TMGB: Telecommunications main grounding bus bar.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."

B. UL listed.

C. RoHS compliant.

D. Compliant with requirements of the Payment Card Industry Data Security Standard.

2.2 EQUIPMENT CABINETS

A. Description: Manufacturer-assembled four-post frame enclosed by side and top panels and front and rear doors, designed for mounting telecommunications equipment. Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
1. For equipment details and specific information, refer to equipment schedules on drawings.
2. The below information is applicable at a minimum, unless otherwise noted:
a. Height: As indicated on Drawings
b. Width: Compatible with 19 inch EIA standard
c. Depth: A minimum of 3 foot (36 inches) in usable depth
d. Material: Extruded Aluminum
e. Finish: Baked-Polyester Powder Coated
f. Color: Black

B. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:
1. Chatsworth Products, Inc. (CPI)
2. Panduit
3. Middle Atlantic
4. Commscope

C. Modular Wall Cabinets:
1. Lockable front doors.
2. Louvered side panels.
3. Cable access provisions top and bottom.
4. Grounding lug.
5. Rack or Roof-mounted, 250-cfm (118-L/s) fan.
6. All cabinets keyed alike.

D. Cable Management:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at top of each relay rack, with a minimum height of two rack units each.
5. height of two rack units each.

2.3 POWER DISTRIBUTION UNIT (PDU)

A. Power Strips: Comply with UL 1363.

B. Description: Rack mounted, vertical and/or horizontal power distribution unit(s) (PDU) dedicated to the supply and routing of power from local uninterruptable power supply (UPS) and/or power outlet. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. A minimum of twelve (12) 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles. A minimum of six (6) receptacles shall be mounted on front and on back.
2. LED indicator lights for power and protection status.
3. LED indicator lights for reverse polarity and open outlet ground.
4. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
5. Cord connected with 15-foot (4.5-m) line cord.
6. Rocker-type on-off switch, illuminated when in on position.

2.4 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Telecommunication Grounding Bars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Wall Mount Telecommunications Primary Busbar (PBB): Refer to specification 270526 and drawing schedules.
2. Wall Mount Telecommunications Secondary Busbar (SBB): Refer to specification 270526 drawing schedules.
3. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
4. Rack-Mounted Horizontal TGB: Designed for mounting in 19 inch (482.6 mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
5. Rack-Mounted Vertical TGB: 36 inches (914.4 mm) long, with stainless-steel or copper-plated hardware for attachment to rack.

2.5 LABELING

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES / EQUIPMENT ROOMS

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
   1. Coordinate with Contracting Officer as required.
   2. If direction for service provider differs from construction drawings, Contracting Officer for coordination.

B. Coordinate all underground and/or wall penetrations with other trades. Refer to drawings, schedules, matrices, and related specifications for pathway and cabling requirements.

C. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground and/or buried pathways.

D. Coordinate

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. For vertical routed cabling, secure cabling at intervals required to be in accordance with manufactures limitations on tension and compression.

F. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.

   1. Meet jointly with system providers, equipment suppliers, and Contracting Officer to exchange information and agree on details of equipment configurations and installation interfaces.
   2. Record agreements reached in meetings and distribute them to other participants.
   3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.

4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

G. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

H. Coordinate layout of ladder runway and ladder rack with HVAC components to ensure air flow is not restricted by pathway and/or cable utilizing the pathway.

I. Coordinate layout of ladder runway and ladder rack with penetrations to ensure installation heights and cable bend radii are acceptable.

J. Backboards:

1. Install from 6 inches (150 mm) to 8 feet 6 inches (2588 mm) above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
2. Paint all sides of backboard with two coats of paint leaving fire rating stamp visible.
3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

3.3 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

C. Locate PBB/SBB to minimize length of bonding conductors. Fasten to wall, allowing proper clearance behind PBB/SBB for standoff. Connect with a minimum No. 4 AWG grounding electrode conductor from PBB/SBB to suitable electrical building ground. Connect rack TGB to near PBB/SBB.

1. Where shielded or armored cabling are utilized, bond the shielding and/or armor to patch panel. Ensure patch panel is properly bonded to rack or rack TGB and in turn, the in-room PBB/SBB.

D. All conduit, cable tray, ladder rack, ladder runway, sleeves and other such metallic routing equipment shall be grounded properly. Pathway within the telecommunication room shall be bonded directly to local PBB/SBB.

3.4 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Ch.

3.6 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 270553 "Identification for Electrical Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Labels shall be machine printed. Type shall be 3/16 inch (5 mm).

END OF SECTION 27 11 16

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Category 6a twisted pair cable.
   2. Twisted pair cable hardware, including panels and jacks.

B. Related Requirements:

   1. Section 270513 "Conductors and Cables for Communications Systems" for data cabling associated with system panels and devices.

1.2 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. Jack: Also commonly called an "outlet," it is the fixed, female connector.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.3 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules:

    a. Electronic copy of labeling schedules, in software and format selected by Contracting Officer.

2. Cabling administration Drawings and printouts.
3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications pathways.
    c. Telecommunications system access points.
    d. Telecommunications grounding system.
    e. Telecommunications conductor drop locations.
    f. Typical telecommunications details.
    g. Mechanical, electrical, and plumbing systems.

C. Twisted pair cable testing plan.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Warranty Documentation

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Connecting Blocks: One of each type.
2. Cover Plates: Five of each type.
3. Jacks: Ten of each type.
4. Patch-Panel Units: One of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field-testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Contracting Officer and the end user's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated:

a. Type CMP complying with UL 1685.

2. Communications, Non-Plenum Rated:

a. Type CMR complying with UL 1666.

B. RoHS compliant.

C. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

1. Panduit
2. Commscope
3. General Cable
4. Superior Essex
5. Hubbel
6. Belden
7. Berktek-Leviton

2.3 CATEGORY 6a TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.

B. Standard: Comply with TIA-568-C.2 for Category 6a cables.

C. Conductors: 100-ohm, 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP).

E. Cable Rating: Plenum.

F. Jacket: Refer to schedules.

2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6a, dependent upon cabling used in conjunction with hardware.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Manufacturer Limitations: Obtain twisted pair cable hardware from single manufacturer that is from same manufacturer of structured cabling. The structured cabling solution shall be an end-to-end solution from a single manufacturer, pursuant to, and in line with, the specific manufacturers product solution warranty.

D. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
3. Number of Jacks per Field: One for each four-pair cable indicated at minimum. Refer to rack elevation and schedules.
4. A minimum of one patch panel shall be dedicated for analog voice communication applications. It shall be connected to the wall mounted 110-block via a 25-pair CAT5E cable. Horizontal cabling scheduled for analog voice use shall be patched from horizontal patch panel to the voice dedicated patch panel.

E. Patch Cords: Factory-made, four-pair cables in lengths as specified in drawing schedules; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.

F. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or cover plate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

G. Cover Plate:

1. Two, Four, and/or Six port, vertical single gang cover plates designed to mount to single gang wall boxes.
2. Plastic Cover Plate: High-impact plastic. Coordinate color with Section 260533 "Raceway and Boxes for Electrical Systems."
3. Metal Cover Plate: Stainless steel, complying with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

a. Flush mounting jacks, positioning the cord at a 45-degree angle.

H. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.6 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to TIA-568-C.1.

B. Factory test twisted pair cables according to TIA-568-C.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Routing:
1. Unless otherwise and specifically indicated, cables shall be installed into, and route through raceways and/or cable trays as indicated below. Cables shall route via:
a. Conduit(s) in all cases from telecom room to outlet/device. Cable shall not be routed freely or exposed in any way outside of the telecom room.

B. Wiring within Enclosures, cabinets, consoles and other such non-architectural equipment.
1. Cable shall route freely without raceway unless equipment provides raceway. Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."

B. Comply with Section 270528 "Pathways for Communications Systems."

C. Comply with Section 270529 "Hangers and Supports for Communications Systems."

D. Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. MUTOA shall not be used as a cross-connect point.
7. Consolidation points may be used only for making a direct connection to equipment outlets:

a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.

b. Locate consolidation points for twisted-pair cables at least 49 feet (15 m) from communications equipment room.

8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
13. Install a 10-foot- (3-m-) long service loop on each end of cable. One loop shall be located in communication room and one shall be located in accessible ceiling near cable termination. Refer to drawing details for more information.
14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart and not less than 48 inches (1220 mm) apart. Spacing of cable supports shall be at alternating distances (between the maximum and minimum separation requirements) to reduce effects of EMI generation on cable run(s). Refer to specification 270529 for cable hanger and support information.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with requirements in Section 270544 “Sleeves and Sleeve Seals for Communications Pathways and Cabling”.

C. Comply with TIA-569-D, Annex A, "Firestopping."

D. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

C. Comply with TIA-607-B and NECA/BICSI-607.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels per indication on drawing schedules and rack elevations.

B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

3.7 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by Contracting Officer. The authorities having jurisdiction shall be included at their discretion, coordinate with Contracting Officer for scheduling and attendees requirements.

B. Tests and Inspections:

1. Perform manufacturer’s recommended test and inspections.
2. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. The following testing procedures shall be applied:
        1) Continuity
        2) Insertion Loss

3) NEXT
4) Return Loss

c. All test reports shall be combined into a single document and provided to the Contracting Officer at completion of testing.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Nonconforming Work:

1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. Collect, assemble, and submit test and inspection reports.

END OF SECTION 27 15 13

SECTION 280010 – SUPPLEMENTAL REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements generally applicable to the Work specified in Division 28.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for abbreviations and acronyms for electrical terms and units of measure, abbreviations and acronyms for electrical raceway types, abbreviations and acronyms for electrical cable types, and additional coordination drawing submittal requirements.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electronic Safety and Security:

1. ACU: (mass notification) Autonomous control unit.
2. BMS: Building management system.
3. FACU: Fire-alarm control unit.
4. HPSA: (mass notification) High power speaker array.
5. LOC: (mass notification) Local operator console.
6. PoE: Power over Ethernet.
7. POTS: Plain old telephone service. See "public switched telephone network."
8. SCBA: Self-contained breathing apparatus.
9. TCP/IP: Transmission control protocol/Internet protocol.

B. Definitions for Electronic Safety and Security:

1. Calling Party Control (CPC): A momentary break in phone line loop current, which is used to signal voicemail and other automated telephone company services that distant party has hung up.
2. Private Branch Exchange (PBX): Analog telephone switch that routes calls internal to a business or organization so a direct external line for each phone is unnecessary.
3. Public Switched Telephone Network (PSTN): Analog telephone technology that uses twisted-pair cables from a telephone-provider central office for the transmission medium. PSTN refers to the telephone network; POTS refers to the individual subscriber line.

4. Remote Office Phone System (ROPS): VoIP system that allows phones for a business or organization located anywhere in the world with internet connectivity to behave similar to phones connected to a PBX.
5. Ringer Equivalence Number (REN): The loading effect of a single traditional telephone ringing circuit. TIA-968 defines REN 1 as an impedance of 7000 Ω at 20 Hz (Type A ringer) or 8000 Ω from 15 Hz to 68 Hz (Type B ringer). The sum of the RENs for all devices on a subscriber line circuit may not exceed the maximum permitted REN for the subscriber line.
6. Voice over Internet Protocol (VoIP): Digital telephone packet technology that uses the internet for its transmission medium.

1.3 COORDINATION

A. Multi-disciplinary coordination requirements: Ensure that all trades and integrators who are impacted or dependent on security scope (either via scheduling, constructability, support, or other such means) are contacted and informed of coordination items relevant to their scope of work at least 10 days prior to commencement of work. Furthermore, ensure all trades and integrators whose work has a similar effect on the security scope of work are contacted for information regarding items relevant to the security scope of work at least 10 days prior to work commencement.

1.4 PREINSTALLATION MEETINGS

A. Electronic Safety and Security Preconstruction Conference: Schedule conference with Contracting Officer not later than **10** days after notice to proceed. Agenda topics include, but are not limited to, the following:

1. Overall construction project schedule
2. Installation schedule for security systems applicable to the project
3. Installation schedule for all systems effecting, or effected by, the security scope of work.
4. Value analysis proposals and requests for substitution of electronic safety and security equipment.
5. Monitoring services work coordination and monitoring service requests.
6. Commissioning activities.
7. Sustainability activities.

1.5 ACTION SUBMITTALS

A. Coordination Drawings: Submit multidiscipline coordination drawings depicting electronic safety and security equipment, devices, cabling, conduit, and duct banks in accordance with requirements specified in Section 260010 "Supplemental Requirements for Electrical."

1.6 INFORMATIONAL SUBMITTALS

A. Installation Schedule for Security: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for installation of security, fire alarm, and other life safety work to Contracting Officer including, but not limited to, milestone dates for the following activities:

1. Submission of specified coordination drawings.
2. Submission of action submittals specified in Division 28.
3. Orders placed for major equipment.
4. Arrival of major equipment on-site.
5. Preinstallation meetings specified in Division 28.
6. Security and fire-alarm system outages.
7. Security and fire-alarm system inspection and activation.
8. Mockup reviews.
9. Closing of walls and ceilings containing security and fire-alarm Work.
10. System startup, testing, and commissioning activities for security and fire-alarm equipment.
11. System startup, testing, and commissioning activities for fire-alarm interfaces with Work specified in other divisions.
12. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
13. Requests for special inspections.
14. Requests for inspections by authorities having jurisdiction.

B. Certificates:

1. Seismic-Load Performance Certificates: Provide special certification as indicated in Paragraph 13.2.2 "Special Certification Requirements for Designated Seismic Systems" of **ASCE/SEI 7-16** for designated seismic-load systems identified on Drawings or in the Specifications.

    a. Include the following information:

        1) Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
        2) Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
        3) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
        4) Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
        5) Provide equipment manufacturer's written certification for each designated active electrical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction.
        6) Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by qualified structural professional engineer.

2. Wind-Load Performance Certificates: Provide special certification for designated wind-load systems and components identified on Drawings or in the Specifications.

    a. Include the following information:

        1) Provide equipment manufacturer's written certification for each designated system and component, stating that it will remain in place and operable following the design wind event and comply with requirements of authorities having jurisdiction.
        2) Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:

    a. Access Control System (ACS) and associated components

2. Include the following information:

    a. Manufacturer's operating specifications.
    b. User's guides for software and hardware.
    c. Schedule of maintenance material items recommended to be stored at Project site.
    d. Detailed instructions covering operation under both normal and abnormal conditions.
    e. Manufacturer's instructions for setting field-adjustable components.
    f. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.
5. Testing and adjusting of panic and emergency power features.

C. Software:

1. Program Software: Provide username and password information as required for Contracting Officer to retain full access to all onsite and cloud-based/hosted software. This shall include access to websites, portals, and any other platform used for updating the existing system, downloading content, and/or for system maintenance.

2. Provide to Contracting Officer upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.

1.8 QUALIFICATIONS

A. Qualified Regional Manufacturer: Manufacturer, possessing qualifications specified in Section 014000 "Quality Requirements," that maintains a service center capable of providing training, parts, and emergency on-site repairs to Project site with response time less than **eight hours**.

B. Security Design Professional: Design professional with active Physical Security Professional (PSP) certification issued by American Society for Industrial Security (ASIS) and with documented experience managing installation of security systems in similar size and complexity.

C. Security Testing Agency: Entity possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

1. On-site security testing supervisor must have an **ASIS** certification and documented training and experience with testing security equipment in accordance with **ASIS** testing standards.

1.9 FIELD CONDITIONS

A. Modeling, analysis, product selection, installation, and quality control for Work specified in Division 28 must comply with requirements specified in Section 260011 "Facility Performance Requirements for Electrical."

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR ELECTRONIC SAFETY AND SECURITY EQUIPMENT

A. Substitution requests for electronic safety and security equipment will be entertained under the following conditions:

1. Substitution requests may be submitted for consideration prior to the Electronic Safety and Security Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for End user throughout life of facility.
2. Contractor is responsible for sequencing and scheduling equipment procurement. After the Electronic Safety and Security Preconstruction Conference, insufficient lead time for equipment delivery will not be considered a valid reason for substitution.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Immediately upon initial (1st day) arrival to site, contractor shall coordinate with General Contractor for all site and project specific information. Contractor shall adhere to all General Contractor requirements throughout duration of project.

2. Prior to commencement of work, contractor shall reference and/or inspect the following conditions:
   a. All safety and security protocols specific to site construction.
   b. The most current version of construction documents as specified in section 1.3.C herein.
   c. The most updated/recent version of project and installation schedule(s).
   d. All coordinated work previously completed and coordinated work that is uncompleted but scheduled for prior completion.
   e. Current construction conditions affecting scope of work.

3. For any and all questions, concerns, coordination, or other project specific information, especially those affecting schedule, quality of work, or system acceptance, contractor shall inform General Contractor in as timely a manner as possible.

B. Preinstallation Testing:

1. It is the contractor's responsibility to ensure that all material and equipment is tested for acceptance pursuant to the manufacturer's specifications and parameters prior to installation.

2. All material and equipment shall be tested for acceptance immediately upon being received by contractor.
   a. If material and/or equipment is received off-site, material and/or equipment shall be retested and confirmed to be acceptable upon arrival on-site.

3. Any material and/or equipment that fails testing procedure and is unacceptable for installation shall be noted and communicated to manufacturer. Dependent upon scope and breadth of failures, contractor shall coordinate required replacement material and maintain installation schedule. If failures affect the installation schedule and/or project schedule, contractor shall inform the General Contractor.

3.2 PREPARATION

A. Protection of In-Place Conditions:

1. Contractor shall always maintain a neat and orderly workspace while on site. The workspace shall not interfere with, or in any other form, disallow other trades to complete their scope of work or maintain proper schedule of work.

2. All tools, material, equipment, trash, etc., shall be maintained to be always neat and orderly while on site.

3. All material and equipment that has been installed shall be protected in place. It is the contractor's responsibility to ensure all installed equipment is protected in place through means of protective coverings, enclosed/restricted spaces, and coordination with other trades. The items of note include, but are not limited to:
   a. Capping/Taping the open ends of unused conduit and open backboxes while protecting pull string.
   b. Covering of all active equipment and termination components to ensure any openings, ports, or other such component orifices are protected from elements such as water, dust, and construction debris and/or material.
   c. Isolation of telecommunication rooms and equipment from general construction whenever possible to minimize water, dust, and construction debris and/or material.
   d. Protection of active equipment from tampering, especially pre-configured or recently configured.
   e. Proper bonding and grounding of all equipment immediately upon installation.

3.3 INSTALLATION OF ELECTRONIC SAFETY AND SECURITY WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' instructions, comply with NFPA 70, NFPA 72, NFPA 731, and NECA NEIS 1 for installation of Work specified in Division 28. Consult Contracting Officer for resolution of conflicting requirements.

3.4 SYSTEM STARTUP

A. Commissioning Activities:

1. Contractor shall reference and adhere to manufacturer's startup/activation requirements for commissioning.

2. Commissioning effort shall ensure that system is complete and operational prior to final testing, system turnover and substantial completion.

3.5 FIELD QUALITY CONTROL

A. Administrant for Security Tests and Inspections:
   1. Contractor shall administer and perform tests and inspections.
   2. Contractor may utilize assistance of factory-authorized service representative, or a third-party certified testing authority, at no cost to Contracting Officer.

3.6 CLEANING

A. Waste Management:

1. Proper disposal and on-site management of all waste material, packaging, and other such extra items not scheduled for install is required. It is the contractor's responsibility to ensure all waste management procedures and protocols are observed and practiced with regards to any and all waste accumulated.

2. Prior to initial (1st day) arrival on site, contractor shall coordinate with General Contractor for current site conditions, rules, regulations, and requirements regarding the accumulation and disposal of waste.

3. The requirements below are in addition to General Contractor defined site requirements, not in lieu of, and shall not supersede any site requirements. Any discrepancy between the below and the site requirements shall be communicated to General Contractor for further clarification.
   a. All trash or waste accumulated shall be properly disposed of at the end of each day.
   b. Any material deemed hazardous must be disposed of immediately. Disposal of material shall be communicated to, and coordinated with, General Contractor.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration:

1. Contractor shall coordinate with Contracting Officer and general contractor to schedule time and attendance for a contractor provided demonstration of the operability of the following systems and equipment:

   a. Access Control System (ACS)

2. It is acceptable for contractor to engage sub-contractors, manufacturer representatives, and/or third parties, to conduct demonstration. Any engagement of such shall be at no cost to Contracting Officer.

3. At Contracting Officer's request, Contractor shall record demonstration(s) or allow Contracting Officer to record demonstration(s). Any contractor provided recording shall be at no extra cost to Contracting Officer.

B. Training:

1. Train end user's maintenance personnel on any system and/or equipment defined herein. Training shall be administered by contractor(s) over a duration as specified below and shall be coordinated with Contracting Officer prior to scheduling. This shall include the training of how to adjust, operate, update, and maintain the system(s) as specified in:
   a. Section 281300 "Access Control Software and Database Management"
      1) 1 hour at minimum

b. Section 281400 “Access Control System Hardware”
   1) 1 hour at minimum

2. At Contracting Officer’s request, contractor shall record training session(s) or allow Contracting Officer to record session(s). Any contractor provided recording shall be at no extra cost to Contracting Officer.

END OF SECTION 28 00 10

SECTION 283100 - INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Intrusion detection with communication links to perform monitoring, alarm, and control functions.
2. Integration of other electronic and electrical systems and equipment.

B. Related Sections:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for power cabling between master control units and field-mounted devices and control units.
2. Section 271313 "Communications Copper Backbone Cabling" for Category 5e, 6, and 7 backbone (riser-rated) cabling.
3. Section 271323 "Communications Optical Fiber Backbone Cabling" for multi- and single-mode backbone (riser-rated) optical fiber.
4. Section 271513 "Communications Copper Horizontal Cabling" for Category 5e, 6, and 7 horizontal (general use, riser-, and plenum-rated) cabling.
5. Section 281300 "Access Control System Software and Database Management" for applications, interfaces, and workstations.
6. Section 282000 "Video Surveillance" for CCTV cameras that are used as devices for video motion detection.

1.3 DEFINITIONS

A. CCTV: Closed-circuit television.

B. PIR: Passive infrared.

C. RFI: Radio-frequency interference.

D. UPS: Uninterruptible power supply.

E. Control Unit: System component that monitors inputs and controls outputs through various circuits.

F. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected

zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.

G. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.

H. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.

I. Standard Intruder: A person who weighs 100 lb (45 kg) or more and whose height is 60 inches (1525 mm) or more; dressed in a long-sleeved shirt, slacks, and shoes unless environmental conditions at the site require protective clothing.

J. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

K. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.

L. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.4 ACTION SUBMITTALS

A. Product Data: Components for sensing, detecting, systems integration, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify programmable logic controllers, networks, and control interface devices and media to be used. Describe characteristics of network and other data communication lines.

    a. Indicate methods used to achieve systems integration.
    b. Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.
    c. Describe characteristics of network and other data communication lines.
    d. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.

2. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection and for systems integration. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.

3. UPS: Sizing calculations.
4. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. Include room layout for master control-unit console, terminal cabinet, racks, and UPS.
5. Master Control-Unit Console Layout: Show required artwork and device identification.
6. Device Address List: Coordinate with final system programming.
7. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
8. Details of surge-protection devices and their installation.
9. Sensor detection patterns and adjustment ranges.

C. Design Data: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For intrusion detection systems integrator.

B. Field quality-control reports.

1. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

C. Product Warranty: Sample of special warranty.

D. Field Test Reports: Test plan and report defining all tests required to ensure that system meets technical, operational, and performance specifications within 60 days of date of Contract award.

E. Evaluation Reports: Examination reports documenting inspections of substrates, areas, and conditions.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Data for each type of product, including features and operating sequences, both automatic and manual.
2. Master control-unit hardware and software data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Intrusion Detection Devices: Furnish quantity equal to five percent of the number of units of each type installed, but no fewer than one of each type.
2. Fuses: Three of each kind and size.
3. Tool Kit: Provide two sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
4. Security Fasteners: Furnish no fewer than 1 box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. An employer of workers, at least one of whom is a Certified Alarm Technician, Level 1.
2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. Layout Responsibility: Preparation of Shop Drawings cabling administration Drawings, and field testing program development by a Technician.
4. Installation Supervision: Installation shall be under the direct supervision of Technician who shall be present at all times when Work of this Section is performed at Project site.

B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

1. At least one of whom is a Certified Systems Integrator.

1.9 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Altitude: Sea level to 8000 feet (2440 m).
2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
3. Interior, Controlled Environment: System components, except master control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambients of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
4. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambients of [0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
5. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.

6. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings shall be rated, listed, and installed according to NFPA 70.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Description: Hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

B. Supervision: System components shall be continuously monitored for normal, alarm, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.

C. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.

D. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

E. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
5. Protected Zone Test: Initiate operational test of a specific protected zone.

6. System Test: Initiate system-wide operational test.
7. Print reports.

F. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.

G. Save Record of Events: Use has the ability to reference a record of alarm, supervisory, and trouble events. Sort and report by protected zone, device, and function. When master control unit receives a signal, record a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.

H. Response Time: A maximum of two seconds between actuation of any alarm and its indication at master control unit.

I. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

J. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

K. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.

C. Comply with NFPA 70.

D. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:

1. Door hardware specified in Section 087100 "Door Hardware."

2. Door hardware specified in Section 087111 "Door Hardware (Descriptive Specification)."
3. Elevators specified in Section 142100 "Electric Traction Elevators."
4. Elevators specified in Section 142400 "Hydraulic Elevators."
5. Lighting controls specified in Section 260923 "Lighting Control Devices."
6. Lighting controls specified in Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
7. Access control system specified in Section 281300 "Access Control System Software and Database Management."
8. Fire alarm system specified in Section 284621.11 "Addressable Fire-Alarm Systems."
9. Fire alarm system specified in Section 284621.13 "Conventional Fire-Alarm Systems."

E. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

F. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

G. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

H. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.

I. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.

J. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.

K. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

2.3 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

C. Exterior Electronics: NEMA 250, Type 4X.

D. Corrosion Resistant: NEMA 250, Type 4X.

E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

A. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

    a. Bosch

B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.

C. Key-Operated Switch: Change protected zone between secure and access conditions.

2.5 Passive Infrared (PIR) SENSORS

A. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

    a. Bosch

B. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.

C. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.

    1. Wall-Mounted Unit Maximum Detection Range: 125 percent of indicated distance for individual units and not less than 50 feet (15 m).
    2. Ceiling-Mounted Unit Spot-Detection Pattern: Full 360-degree conical.
    3. Ceiling-Mounted Unit Pattern Size: 84-inch (2135-mm) diameter at floor level for units mounted 96 inches (2440 mm) above floor; 18-foot (5.5-m) diameter at floor level for units mounted 25 feet (7.6 m) above floor.

D. Device Performance:

    1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard-intruder movement within sensor's detection patterns at

any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across two adjacent segments of detector's field of view.

2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.

2.6 MASTER CONTROL UNIT

A. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

   a. Bosch

B. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.

   1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   2. Include a real-time clock for time annotation of events on the event recorder and printer.
   3. Addressable initiation devices that communicate device identity and status.
   4. Control circuits for operation of mechanical equipment in response to an alarm.

C. Construction: Desk-mounted console, modular, with separate and independent alarm and supervisory system modules. Arrangements that require removal of field wiring for module replacement are unacceptable.

D. Comply with UL 609.

E. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

   1. Annunciator and Display: LCD, multiple line(s) of 80 characters, minimum.
   2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
   3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
   4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
   5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:

a. Acknowledge alarm.
b. Silence alarm.
c. System reset.
d. LED test.

6. Timing Unit: Solid state, programmable, 365 days.
7. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
8. Alarm Indication: Audible signal sounds and a plain-language identification of the protected zone and/or addressable detector originating the alarm appears on LED or LCD display at master control unit. Annunciator panel displays a common alarm light and sounds an audible tone.
9. Alarm activation sounds a bell or siren and strobe.

F. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.

G. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a 25 percent increase in load.

H. UPS shall be sized to provide a minimum of six hours of master control-unit operation.

I. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify, with permanent labels, individual components and modules within cabinets.

J. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.

K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

2.7 SECURITY FASTENERS

A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.

B. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

a. Approved Equal

C. Socket Flat Countersunk Head Fasteners:

1. Heat-treated alloy steel, ASTM F835 (ASTM F835M).
2. Stainless steel, ASTM F879 (ASTM F879M), Group 1 CW.

D. Socket Button Head Fasteners:

1. Heat-treated alloy steel, ASTM F835 (ASTM F835M).
2. Stainless steel, ASTM F879 (ASTM F879M), Group 1 CW.

E. Socket Head Cap Fasteners:

1. Heat-treated alloy steel, ASTM A574 (ASTM A574M).
2. Stainless steel, ASTM F837 (ASTM F837M), Group 1 CW.

F. Protective Coatings for Heat-Treated Alloy Steel:

1. Zinc chromate, ASTM F1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.
2. Zinc phosphate with oil, ASTM F1137, Grade I, or black oxide unless otherwise indicated.

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 intrusion detection.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

D. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INTEGRATION

A. Integrate intrusion detection system with the following systems and equipment:

1. Electronic door hardware.
2. Elevators.
3. Network lighting controls.
4. Intercommunications and program systems.
5. Access control.
6. Fire-alarm system.
7. Perimeter security system.
8. Existing NPS off-site system and local police department.

3.3 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."

C. Connection to existing monitoring system
1. The US Park Police at the Presidio is the monitoring station for this building. Contractor shall coordinate with Contracting Officer to ensure the communication between the sites are enabled, utilizing the existing communications protocols in place at the Presidio.
2. It is expected that an analog phone line connection to the system panel at the new building will provide the communication needed.

3.4 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Section 270528 "Pathways for Communications Systems." Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
2. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
4. Data and Television Signal Transmission Cables: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

E. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

F. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 270553 "Identification for Communications Systems."

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Section 270553 "Identification for Communications Systems."

B. Install instructions frame in a location visible from master control unit.

3.6 GROUNDING

A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.

B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.

D. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Section 270526 "Grounding and Bonding for Communications Systems."

3.7 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones

and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

D. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

E. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.

3.9 DEMONSTRATION

A. Train end user's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Coordinate training schedule with contracting officer. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."
1. It is acceptable to engage a factory authorized representative to assist in, or lead, the training effort.

END OF SECTION 283100

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.
10. Radio alarm transmitter.
11. System printer.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

B. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Contracting Officer.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified fire-alarm technician, Level IV minimum.
    c. Licensed or certified by authorities having jurisdiction.

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

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. Delegated-Design Submittal: For smoke and heat detectors 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. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

D. Qualification Data: For qualified Installer.

E. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

1.8 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Contracting Officer to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.

3. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamper-proofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Bosch Security Systems:
   a. Annunciator: B926F
   b. Control Panel: B9512G, B520
2. Honeywell:
   a. Power Supply: HPF24S6 / HPF24S8
3. Other manufacturers: All systems, detectors, notification devices, etc. must be compatible with the above Bosch Security System Fire Alarm Control Panel and Bosch systems.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Flame detectors.
4. Smoke detectors.
5. Duct smoke detectors.
6. Verified automatic alarm operation of smoke detectors.
7. Automatic sprinkler system water flow.
8. Heat detectors in elevator shaft and pit.
9. Fire-extinguishing system operation.
10. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
9. Activate stairwell and elevator-shaft pressurization systems.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Recall elevators to primary or alternate recall floors.
12. Activate emergency lighting control.
13. Activate emergency shutoffs for gas and fuel supplies.
14. Record events in the system memory.
15. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
b. Provide communication between the se and remote circuit interface panels, annunciators, and displays.
c. The FACP shall be listed for connection to a central-station signaling system service.
d. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable initiation devices that communicate device identity and status.

a. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
b. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
c. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment: The FACP shall be listed for releasing service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

a. Initiating Device Circuits: Style D.
b. Notification Appliance Circuits: Style Z.
c. Signaling Line Circuits: Style 2
d. Install no more than 50 addressable devices on each signaling line circuit.

2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

a. Initiating Device Circuits: Style A
b. Notification Appliance Circuits: Style W

c. Signaling Line Circuits: Style 0.5
d. Install no more than 50 addressable devices on each signaling line circuit.

3. Serial Interfaces: Two RS-232 ports for printers.

D. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.

1. Pressurization starts when any alarm is received at fire-alarm control unit.
2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.

E. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

L. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.

b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Continuous Linear Heat-Detector System:

1. Detector Cable: Rated detection temperature 155 deg F (68 deg C). NRTL listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short- circuit wires at the location of elevated temperature.
2. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
3. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Surface cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line and dial a preset number for a remote central station at the Presidio. Refer to Intrusion Detection specification for additional information. When contact is made with central station(s), signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Zone of the supervisory signal.
3. Zone of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 RADIO ALARM TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.

B. Comply with 47 CFR 90.

C. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.

5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
7. Antenna-Cable Connectors: Weatherproof.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

D. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

2.13 SYSTEM PRINTER

A. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

2.14 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches (1830 mm) above the finished floor. Comply with requirements for concrete base specified in Division 03 Section "[Cast-in-Place Concrete] [Miscellaneous Cast-in-Place Concrete]."

1. Install seismic bracing. Comply with requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A [or Appendix B]in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

G. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

H. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

L. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

M. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

N. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist 100-mph (160-km/h) wind load with a gust factor of 1.3 without damage.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.

10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Contracting Officer.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.

5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 11

SECTION 31 05 13 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil materials.
2. Topsoil materials.

B. Related Requirements:
1. Section 312213 - Rough Grading: Removal of topsoil, rough grading, and filling associated with contouring of Site.
2. Section 312316 - Excavation: Excavating as required for building foundations and utilities within building perimeter.
3. Section 312316.13 - Trenching: Excavating as required for building foundations and utilities within building perimeter.
4. Section 312323 - Fill: Backfilling as required at building perimeter and Site structures to subgrade elevations.
5. Section 312500 - Erosion and Sedimentation Controls: Slope protection and erosion control.
6. Section 320516 - Aggregates for Exterior Improvements: Coarse and fine aggregate materials.
7. Section 329219 - Seeding: Fertilizing, seeding, hydroseeding, mulching, and maintenance.
8. Document 0206170-000: Design Level Geotechnical Investigation; bore hole locations and findings of subsurface materials.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
3. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit name of imported materials source.

C. Samples: Submit, in airtight containers, 10-lb. sample of each type of fill to testing laboratory.

D. Supplier's Certificate: Certify that products meet or exceed specified requirements.

E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate:

1. Certify that products meet or exceed specified sustainable design requirements.
2. Materials Resources Certificate: Certify source for regional materials and distance from Project Site.

C. Product Cost Data:

1. Submit cost of products to verify compliance with Project sustainable design requirements.
2. Exclude cost of labor and equipment to install products.
3. Provide cost data for following products:

a. Regional products.

1.5 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout Work.

B. Perform Work according to local jurisdiction standards.

C. Maintain onecopy of each standard affecting Work of this Section on Site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

1. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

2.2 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing and Analysis:

1. Subsoil Material: Comply with ASTM D698, ASTM D1557 and ASTM D6938.
2. Topsoil Material: Comply with ASTM D698, ASTM D1557 andASTM D6938.
3. If tests indicate materials do not meet specified requirements, change material and retest.

C. Government Inspection:

1. Make subsoil and topsoil available for inspection at source prior to packaging for shipment.
2. Notify Government at least seven days before inspection is allowed.

D. Government Witnessing:

1. Allow witnessing of source testing at supplier's test facility.
2. Notify Government at least seven days before tests are scheduled.

E. Certificate of Compliance:

1. If supplier is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at source conforms to Contract Documents.
2. Specified source tests are not required for Work performed by approved supplier.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavation:

1. Excavate subsoil and topsoil from designated areas.
2. Strip topsoil to full depth of topsoil in designated areas.
3. Remove excess excavated materials not intended for reuse from Site.
4. Remove excavated materials not meeting requirements for subsoil and topsoil materials from Site.

B. Stockpiling:

1. Stockpile excavated material meeting requirements for subsoil and topsoil materials.
2. Stockpile materials on Site at locations as indicated by COR.
3. Stockpile in sufficient quantities to meet Project schedule and requirements.
4. Separate differing materials with dividers or stockpile apart to prevent intermixing of soil types or contamination.
5. Stockpile topsoil maximum 3 feet high.
6. Direct surface water away from stockpile to prevent erosion or deterioration of materials.
7. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching until they are disposed.

3.2 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Stockpile:

1. Remove stockpile and leave area in clean and neat condition.
2. Grade Site surface to prevent freestanding surface water.

END OF SECTION 31-05-13

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing surface debris.
2. Removing designated paving, curbs, and sidewalk.
3. Removing designated trees, shrubs, and other plant life.
4. Removing abandoned utilities.
5. Excavating topsoil.

B. Related Sections:

1. Section 024116 - Structure Demolition: Removing underground storage tanks and designated utilities.
2. Section 312213 - Rough Grading.

1.2 QUALITY ASSURANCE

A. Conform to applicable municipal code for disposal of debris.

B. Perform Work in accordance with Colorado Department of Transportation standards.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify waste area for placing removed materials.

2.2 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping

C. Protect bench marks, survey control points, and existing structures from damage or displacement.

2.4 CLEARING

A. Clear areas required for access to site and execution of Work to minimum depth of 6 inches.

B. Remove trees and shrubs as indicated. Remove stumps and surface rock as indicated.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

2.5 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Remove paving, curbs, and sidewalk as indicated.

C. Partially remove paving, curbs, and, sidewalks as indicated on Drawings. Neatly saw cut edges at right angle to surface.

D. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

F. Do not burn or bury materials on site. Leave site in clean condition.

2.6 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion.

D. Remove excess topsoil not intended for reuse, from site.

END OF SECTION 31 10 00

SECTION 31 22 13 - ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, and compacting site for site structures, and building pads.

B. Related Sections:

1. Section 024116 - Structure Demolition.
2. Section 310513 - Soils for Earthwork: Soils for fill.
3. Section 311000 - Site Clearing: Excavating topsoil.
4. Section 312316 - Excavation: Building excavation.
5. Section 312317 - Trenching: Trenching and backfilling for utilities.
6. Section 312323 - Fill: General building area backfilling.

1.2 REFERENCES

A. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.
b. Regional products.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

B. Perform Work in accordance with Municipality of Stinson Beach Public Work's standard.

C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content .

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at 800-642-2444 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility companies to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.

F. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material and cover over with same material, until disposal.

D. Remove excess topsoil not intended for reuse, from site.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, relandscaped, or regraded.

B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

C. When excavating through roots, perform Work by hand and cut roots with sharp axe.

D. Stockpile excavated material in area designated on site in accordance with Section 310513.

E. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place material in continuous layers as follows:

1. Subsoil Fill: Maximum 8 inches compacted depth.
2. Structural Fill: Maximum 6 inches compacted depth.
3. Granular Fill: Maximum 6 inches compacted depth.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft , unless noted otherwise.

E. Make grade changes gradual. Blend slope into level areas.

F. Repair or replace items indicated to remain damaged by excavation or filling.

3.6 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.7 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557.

C. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.8 SCHEDULES

A. Structural Fill:
1. Compact uniformly to minimum 95 percent of maximum density.

B. Previous Structural Fill:
1. Compact uniformly to minimum 95 percent of maximum density.

C. Subsoil Fill:
1. Compact uniformly to minimum 95 percent of maximum density.

D. Topsoil Fill:
1. Compact uniformly to minimum 90 percent of maximum density.

END OF SECTION 31-22-13

SECTION 312219 - TOPSOIL

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

A. The General Contract Conditions, Drawings and Division 01 Specification sections apply to work of this section.

1.2 SUMMARY:

A. Work Includes: Furnishing, stockpiling and placing sand or topsoil/organic material on a previously prepared subgrade.

1.3 QUALITY ASSURANCE: Submit soil analysis reports for onsite topsoil from the State University Agricultural Extension Service or other approved soil testing laboratory. Report shall cover soil textural classification (percentages of sand, silt, and clay), pH, percentage organic matter, and soluble salts (electric conductivity in millimos/centimeter), and shall include additive recommendations. Testing will be at the expense of the Contractor.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Do not deliver or place topsoil in a frozen, wet, or muddy condition.

B. Topsoil is to be stored in windrows with 36” maximum height.

PART 2 PRODUCTS

2.1 ON-SITE TOPSOIL: Topsoil/organic material previously stripped and stockpiled prior to earthwork operations.

2.2 IMPORTED TOPSOIL: No imported topsoil is allowed. Soil may be available from areas adjacent to the work, locations to be reviewed and approved by Contracting Officer prior to stripping.

A. It shall be obtained from the top twelve inches (12”) of well drained areas.

B. Fertile, friable, sand with topsoil, reasonably free from subsoil, refuse, roots, heavy or stiff clay, stones larger than one inch (1”), noxious seeds, sticks, brush, litter, and other deleterious substances; suitable for the germination of seeds, and the support of vegetative growth. The pH value shall be between seven and eight (7.0 and 8.0).

C. Soil Texture: to match in situ material

D. Additives: As determined by soil fertility test and with prior approval from Contracting Officer.

PART 3 EXECUTION

3.1 PLACING TOPSOIL:

A. Scarify compacted subgrade to a six inch (6”) depth to bond topsoil to subsoil. Place topsoil to a minimum depth of two inches (2”) after settlement. Topsoil shall be free from weeds, sod, clods and material stones larger than one inch (1”), toxic substances, litter and other deleterious material. Spread evenly and grade to elevations and slopes shown on Drawings. Hand rake areas inaccessible to machine grading.

B. Utilize salvaged topsoil/organic as the top layer to the extent available. If sufficient on-site material is not available, Contractor shall furnish and install imported topsoil if approved by Contracting Officer. Topsoil shall be mixed thoroughly with the salvaged topsoil prior to placement.

END OF SECTION 312219

SECTION 31 23 16 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil densification.
2. Excavating for building foundations.
3. Excavating for paving, roads, and parking areas.
4. Excavating for slabs-on-grade.
5. Excavating for site structures.
6. Excavating for landscaping.

B. Related Sections:
1. Section 310513 - Soils for Earthwork: Stockpiling excavated materials.
2. Section 312213 - Rough Grading: Topsoil and subsoil removal from site surface.
3. Section 312317 - Trenching: Excavating for utility trenches.
4. Section 312323 - Fill.
5. Section 331416 - Site Water Utility Distribution Piping.

1.2 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with California Department of Transportation standards.

PART 2 - PRODUCTS

2.1 Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Protect utilities indicated to remain from damage.

D. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

E. Protect bench marks, survey control points, existing structures, paving, and curbs from excavating equipment and vehicular traffic.

3.2 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving, site structures and construction operations.

C. Excavate to working elevation for piling work.

D. Slope banks with machine.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Trim excavation. Remove loose matter.

G. Remove lumped subsoil and boulders.

H. Notify Contracting Officer of unexpected subsurface conditions.

I. Remove excess and unsuitable material from site.

3.3 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 31 23 16

SECTION 31 23 16.13 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations
3. Backfilling and compaction.

B. Related Sections:

1. Section 033000 - Cast-In-Place Concrete: Concrete materials.
2. Section 310513 - Soils for Earthwork: Soils for fill.
3. Section 312213 - Rough Grading: Topsoil and subsoil removal from site surface.
4. Section 312316 - Excavation: General building excavation.
5. Section 312323 - Fill: General backfilling.
6. Section 331416 - Site Water Utility Distribution Piping: Water piping and bedding from building to utility service.
7. Section 333111 - Sanitary Utility Sewerage Piping: Sanitary sewer piping and bedding from building to utility service.
8. Document 0206170-000: Design Level Geotechnical Investigation; bore hole locations and findings of subsurface materials.

1.2 REFERENCES

A. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Product Data: Submit data for geotextile fabric indicating fabric and construction.

D. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

E. Materials Source: Submit name of imported fill materials suppliers.

F. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.
b. Regional products.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with Municipality of Stinson Beach Public Work's standard.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - EXECUTION

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

2.2 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.

1. Owner] reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

2.3 PREPARATION

A. Call Local Utility Line Information service at 800-642-2444 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

2.4 TRENCHING

A. Excavate subsoil required for utilities to utility service.

B. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume. Remove larger material as specified.

C. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.

D. Do not advance open trench more than 200 feet ahead of installed pipe.

E. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.

F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.

G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.

H. Do not interfere with 45 degree bearing splay of foundations.

I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.

J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth until suitable material is encountered.

K. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal to or greater than requirements for subsequent backfill material.

L. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

M. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

N. Stockpile excavated material in area designated on site in accordance with Section 310513.

2.5 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

2.6 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place geotextile fabric prior to placing subsequent fill materials.

D. Place material in continuous layers as follows:

1. Subsoil Fill: Maximum 8 inches compacted depth.
2. Structural Fill: Maximum 6 inches compacted depth.
3. Granular Fill: Maximum 6 inches compacted depth.

E. Employ placement method that does not disturb or damage foundation perimeter drainage or utilities in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Do not leave more than 50 feet of trench open at end of working day.

H. Protect open trench to prevent danger to the public.

2.7 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling: Plus or minus 0.2 feet from required elevations.

C. Top Surface of General Backfilling: Plus or minus 0.2 feet from required elevations.

2.8 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557.

C. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922.
2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

2.9 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution and Closeout Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

2.10 SCHEDULE

A. Storm and Sanitary Piping:

1. Cover pipe and bedding with Fill: To subgrade elevation.
2. Compact uniformly to minimum 95 percent of maximum density.

B. Duct Bank:

1. Cover duct and bedding with Fill: To subgrade elevation.
2. Compact uniformly to minimum 95 percent of maximum density.

END OF SECTION 31 23 16.13

SECTION 31 23 19 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dewatering system.
2. Surface water control system.
3. Monitoring wells.
4. System operation and maintenance.
5. Water disposal.

B. Related Requirements:

1. Document 003100 - Available Project Information: Subsurface investigation report, indicating boring logs, soil profiles, ground water levels with seasonal variations, pumping tests, and laboratory soils analyses.
2. Section 312316 - Excavation: Excavation for structures below ground water table.
3. Section 312316.13 - Trenching: Trenching for utilities below ground water table.
4. Section 312500 - Erosion and Sedimentation Controls: Surface water runoff control.

1.2 DEFINITIONS

A. Dewatering:

1. Lowering of ground water table and intercepting horizontal water seepage to prevent ground water from entering excavations and trenches.
2. Reducing piezometric pressure within strata to prevent failure or heaving of excavations and trenches.
3. Disposing of removed water.

B. Piezometer: A tube inserted into a vessel or pipe to indicate the height (pressure) that a liquid can rise in the tube.

C. Pitometer: A measuring device that transforms a differential pressure into an electrical output current proportional to the flow rate.

D. Surface Water Control: The removal of surface water within open excavations.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

1.4 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section to permit following construction operations to be completed on dry and stable substrate:

1. Excavation for structures as specified in Section 312316 - Excavation.
2. Trenching for utilities as specified in Section 312316.13 - Trenching.

1.5 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.6 SEQUENCING

A. Section 011000 - Summary: Requirements for sequencing.

B. Sequence Work of this Section to obtain required permits before start of dewatering operations.

C. Sequence Work of this Section to install and test monitoring systems minimum seven days before testing and operating dewatering systems.

D. Sequence Work of this Section to install and test dewatering and surface water control systems minimum seven days before starting excavation and trenching.

1.7 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit sizes, capacities, priming method, and engine characteristics for dewatering pumps.
2. Submit pumping equipment for control of surface water within excavation.

C. Shop Drawings:

1. Indicate dewatering system layout, dewatering pump locations, pipe sizes and capacities, grades, filter sand gradations, surface water control devices, valves, and water disposal method and location.
2. Indicate primary and standby power system location and capacity.
3. Indicate layout and depth of piezometers and flow measuring devices for system performance measurement.
4. Include detailed description of dewatering and monitoring system installation procedures and maintenance of equipment.
5. Include description of emergency procedures to follow when problems arise.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Delegated Design Submittals:

1. Submit signed and sealed Shop Drawings.
2. Indicate design values, analyses, assumptions, and calculations to support design.
3. Include description and profile of geology, soil, and ground water conditions.
4. Submit signed and sealed survey of existing adjacent buildings, structures, and improvements for position and elevation of principal elements before and after completion of dewatering operations.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, and testing and monitoring reports.

G. Reports:

1. Initial Installation Report:

a. Installation and development reports for pumps.
b. Installation and baseline reports for monitoring of piezometers.
c. Initial dewatering flow rates.

2. Weekly Monitoring Reports:

a. Dewatering flow rates.
b. Piezometer readings.
c. Test reports of discharge water analysis.
d. Maintenance records for dewatering and surface water control systems.

H. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.

1.8 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

1.9 QUALITY ASSURANCE

A. Comply with authorities having jurisdiction for following:
1. Water discharge and disposal from pumping operations.

B. Obtain permit from EPA under National Pollutant Discharge Elimination System (NPDES) for stormwater discharge from Site.

C. Perform Work according to local jursidiction standards.

D. Maintain onecopy of each standard affecting Work of this Section on Site.

1.10 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 three years' documented experience.

C. Licensed Professionals:

1. Professional engineer experienced in design of specified Work and licensed at Project location.
2. Surveyor experienced in specified Work and licensed at Project location.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Furnish dewatering and surface water control systems to permit Work to be completed on dry and stable subgrade.

B. Standby Equipment:

1. Store at Site and ready for immediate use upon failure of dewatering equipment.
2. Dewatering Centrifugal Pumps: One for every two installed pumps.
3. Dewatering Turbine Pumps: One for every five installed pumps.
4. Pump Power Units: One for every two installed pumps.
5. Dewatering Jet Eductor Pressure Pumps: One for every two installed pumps.
6. Portable Electric Generators: One for every three installed pumps.
7. Commercial Electric Power: 100 percent standby electric generating equipment.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Design:

1. Lower water table within areas of excavation tominimum 2 feet below bottom of excavation to permit Work to be completed on dry and stable subgrade.
2. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.
3. Prevent damage to adjacent properties, buildings, structures, utilities, and other facilities from construction operations.
4. Prevent loss of fines, quick condition, or softening of foundation subgrade.
5. Maintain stability of sides and bottoms of excavations and trenches.
6. Surface Water Control System: Collect and remove surface water and seepage entering excavation.

2.3 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.

2.4 MONITORING EQUIPMENT

A. Piezometers:

1. Description: Sand filter installation to monitor water elevation.
2. Type: Standpipe.
3. Accessories: Signal cable and data recorder.

B. Flow Measurement Devices:
1. Pitometer installed to measure flow from entire dewatering system.

2.5 ACCESSORIES

A. Valves and Fittings: Furnish valves and fittings as required to isolate each well from header pipe and to prevent loss of pump prime.

B. Filter Sand:

1. Description: Natural river or bank sand, washed, and free of silt, clay, loam, friable, or soluble materials.
2. Comply with ASTM C33/C33M.
3. Grading: To suit well screen.

C. Grout: Mixture of portland cement and bentonite clay or sand suitable for sealing abandoned wells and piping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Conduct additional borings and investigations to supplement subsurface investigations identified in Document 003100 - Available Project Information, as required to complete dewatering system design.

C. Utility Service Locator:

1. Call local utility service-line information at 800-642-2444 not less than three working days before performing Work.
2. Request that underground utilities be located and marked within and immediately surrounding Site.
3. Identify required lines, levels, contours, and data.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Protect existing adjacent buildings, structures, and improvements from damage that may be caused by dewatering operations.

3.3 DEWATERING SYSTEM

A. Install dewatering system according to Shop Drawings.

B. Locate system components to allow continuous dewatering operations without interfering with installation of permanent Work and existing public rights-of-way, sidewalks, and adjacent buildings, structures, and improvements.

C. Pumps:

1. Install according to manufacturer instructions.
2. Connect pumps to discharge header.
3. Install valves to permit pump isolation.

3.4 SURFACE WATER CONTROL SYSTEM

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area, as specified in Section 312500 - Erosion and Sedimentation Control.

B. Divert surface water and seepage water within excavation areas into sumps and pump water into storm drains, according to requirements of authorities having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

3.5 SYSTEM OPERATION AND MAINTENANCE

A. Operate dewatering system continuously until backfill is minimum 2 feet above normal ground water table elevation.

B. Provide 24-hour supervision of dewatering system by personnel skilled in operation, maintenance, and replacement of system components.

C. Monitoring:

1. Conduct daily observation of dewatering system and monitoring system.
2. Make required repairs and perform scheduled maintenance.

D. Fill fuel tanks before tanks drop to 25 percent capacity.

E. Start emergency generators at least twice each week to check operating condition.

F. System Failure:

1. If dewatering system cannot control water within excavation, notify Contracting Officer and stop excavation Work.
2. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
3. Demonstrate that dewatering system operation complies with performance requirements before resuming excavation operations.

G. Modify dewatering and surface water control systems if operation causes or threatens to cause damage to new construction, existing Site improvements, adjacent property, or adjacent water wells.

H. Correct unanticipated pressure conditions affecting dewatering system performance.

I. Do not discontinue dewatering operations without approval of Contracting Officer.

3.6 WATER DISPOSAL

A. Discharge water into existing storm sewer system.

3.7 SYSTEM REMOVAL

A. Remove dewatering and surface water control systems after dewatering operations are discontinued.

B. Remove piezometers.

C. Repair damage caused by dewatering and surface water control systems or resulting from failure of systems to protect property.

3.8 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Testing:
1. Adjust pump speed, discharge volume, or both to ensure proper operation of each pump.

C. Monitoring and Recording:

1. Sand Content:

a. Monitor ground water discharge for sand content.
b. Maximum Permitted Sand Content: 5 ppm.

2. Contaminates:

a. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

b. Sample and test water weekly for contaminates.

3. Existing Adjacent Buildings, Structures, and Improvements:

a. Survey weekly during dewatering to detect movement in comparison to original elevations.
b. Notify Contracting Officer immediately of measured movement.

3.9 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect monitoring well standpipes from damage by construction operations.

END OF SECTION 31 23 19

SECTION 31 23 23 - FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs on grade.
4. Fill under paving.
5. Fill for over-excavation.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete materials.
2. Section 310513 - Soils for Earthwork: Soils for fill.
3. Section 312213 - Rough Grading: Site filling.
4. Section 312316 - Excavation: Backfilling of building foundations and utilities within building perimeter.
5. Section 312316.13 - Trenching: Backfilling of utility trenches.
6. Section 331416 - Site Water Utility Distribution Piping: Pipe materials, fittings, valves, meters, and backflow preventers.
7. Section 333111 - Sanitary Sewerage Piping: Pipe materials and accessories normally encountered with gravity sanitary building piping.
8. Document 0206170-000: Design Level Geotechnical Investigation; bore hole locations and findings of subsurface materials.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
2. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D6031/D6031M - Standard Test Method for Logging In Situ Moisture Content and Density of Soil and Rock by the Nuclear Method in Horizontal, Slanted, and Vertical Access Tubes.
6. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for geotextile fabric, indicating fabric and construction.

C. Samples: Submit, in airtight containers, **one 10**-lb. sample of **each type of** fill to testing laboratory.

D. Materials Source: Submit name of imported materials suppliers.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate:

1. Certify that products meet or exceed specified sustainable design requirements.
2. Materials Resources Certificates:

    a. Certify source and origin for **salvaged and reused** products.
    b. Certify recycled material content for recycled content products.
    c. Certify source for regional materials and distance from Project Site.

C. Product Cost Data:

1. Submit cost of products to verify compliance with Project sustainable design requirements.
2. Exclude cost of labor and equipment to install products.
3. Provide cost data for following products:

    a. Salvaged, refurbished, and reused products.
    b. Products with recycled material content.
    c. Regional products.

1.5 QUALITY ASSURANCE

A. Perform Work according to local jurisdiction standards.

B. Maintain one **copy** of each standard affecting Work of this Section on Site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content .

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site**.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that subdrainage, dampproofing, and waterproofing installations have been inspected.

C. Verify that underground tanks are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural integrity of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Compact subgrade to specified density requirements for subsequent backfill materials.

C. Soft Subgrade:

1. Cut out soft areas of subgrade not capable of compaction in place.
2. Backfill with **granular** fill and compact to density equal to or greater than specified requirements for subsequent fill material.

D. Scarify subgrade surface to depth of 8 inches.

3.3 BACKFILLING

A. Backfill areas to contours and elevations.

B. Systematically backfill to allow maximum time for natural settlement.

C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces, and do not backfill with frozen materials.

D. Maximum Compacted Depths:

1. Place material in continuous layers to following depths:

a. Subsoil Fill: **8** inches.
b. Structural Fill: **6** inches.
c. Granular Fill: **6** inches.

E. Use placement method that does not disturb or damage **foundation perimeter drainage or** utilities in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Structures:

1. Backfill against supported **foundation walls**.
2. Backfill simultaneously on each side of unsupported **foundation walls and** until supports are in place.
3. Slope grade away from building minimum **2** percent slope for minimum distance of **10** feet.

H. Make gradual grade changes and blend slope into level areas.

I. Remove surplus backfill materials from Site.

J. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Top Surface of Backfilling **within Building Areas**: Plus or minus **1** inch from required elevations.

C. Top Surface of Backfilling **under Paved Areas**: Plus or minus **1** inch from required elevations.

D. Top Surface of General Backfilling: Plus or minus **1** inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Inspecting: Request visual inspection of bearing surfaces by **inspection agency** before installing subsequent Work.

C. Testing:

1. Laboratory Material Testing: Comply with **ASTM D1557**.
2. In-Place Compaction Testing:

    a. Density Tests: Comply with ASTM **D1556/D1556M, D2167, or D6938**.
    b. Moisture Tests: Comply with ASTM D6031/D6031M.

3. If tests indicate that Work does not meet specified requirements, remove Work, replace, compact, and retest.
4. Proof-roll compacted fill surfaces under **slabs on grade** and **paving**.

3.6 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Reshape and recompact fills subjected to vehicular traffic during construction.

3.7 ATTACHMENTS

A. Fill Under Landscaped Areas: Fill to **12** inches below finish grade; compacted uniformly.

B. Fill under **Asphalt** and **Concrete** Paving:

1. Compact subsoil to **95** percent of maximum density.
2. Fill to 6 inches below finish paving elevation; compacted uniformly to 95 percent of maximum density.

C. Fill to Correct Over-Excavation:
1. Fill flush to specified elevation; compacted uniformly to 95 percent of maximum density.

END OF SECTION 31 23 23

SECTION 31 25 00 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sediment Traps.
   2. Cleaning Sedimentation Structures

B. Related Sections:

   1. Section 031000 - Concrete Forming and Accessories.
   2. Section 032000 - Concrete Reinforcing.
   3. Section 033000 - Cast-In-Place Concrete.
   4. Section 311000 - Site Clearing.
   5. Section 312316 - Excavation.
   6. Section 321313 - Concrete Paving.
   7. Section 329219 - Seeding and Soil Supplements.

1.2 REFERENCES

A. American Concrete Institute:

   1. ACI 301 - Specifications for Structural Concrete.

B. ASTM International:

   1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
   4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Product Data: Submit data on admixtures, curing compounds,and geotextile.

C. Submit proposed mix design of each class of concrete for review prior to commencement of Work.

D. Samples:

1. Submit two samples or rock, minimum 5 tons each or one half total project quantity, whichever is smaller. Provide one sample in place at construction site and provide other sample at quarry. Construction site sample may be incorporated into the Work. Samples will be used as reference for judging size, and graduation of rock supplied and placed.

E. Test Reports: Indicate certified tests results for precast concrete at manufacturing facility, cast-in-place concrete in field, and granular backfill.

F. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.
b. Regional products.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with requirements of Section 311000, Section 312316, Section 321313, and Section 329219,.

B. Perform Work according to Municipality] ofof Stinson Beach Public Works standards.

C. Maintain one copy of each document on site.

1.7 PRE-INSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

B. Do not place grout when air temperature is below freezing.

C. Do not place concrete when base surface temperature is less than 40 degrees F , or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content .

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

2.2 ROCK AND GEOTEXTILE MATERIALS

A. Furnish materials according to Municipality of Stinson Beach Public Works standards.

B. Rock: Sound, hard and angular shape; well graded; without shale seams, structural defects and foreign substances; with width and thickness greater than one third its length; minimum specific gravity of 2.5, as determined in accordance with ASTM C127, bulk saturated, and surface dry basis; minimum durability determined by petrographic examination; size and gradation in accordance with NCSA Class, Size No. R6 within following limits:

1. Percent Passing per NCSA Size No. and Square Opening Size:

a. R6:

1) 24 Inches :100.
2) 12 Inches :15 to 50.
3) 6 Inches :Zero to 15.

C. Geotextile Fabric: Furnish according to Municipality of Stinson Beach Public Works standards.

2.3 BLOCK, STONE, AGGREGATE, AND SOIL MATERIALS

A. Coarse Aggregate: Furnish according to Municipality of Stinson Beach Public Works standards.

B. Soil Backfill: Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.4 PLANTING MATERIALS

A. Seeding and Soil Supplements:Furnish according to Municipality of Stinson Beach Public Works standards.

B. Mulch: As specified in Section 329219.

2.5 PIPE MATERIALS

A. Pipe: Furnish according to Municipality of Stinson Beach Public Works standards.

2.6 SOURCE QUALITY CONTROL (AND TESTS)

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.

C. Test samples in accordance with ACI 301.

D. Make materials available for inspection at producer'squarry site prior to shipment. Notify Government] at least seven days before inspection is allowed.

E. Allow witnessing of inspections and test at manufacturer's test facility. Notify Government at least seven days before inspections and tests are scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of base or foundation for other work are correct.

3.2 SEDIMENT TRAPS

A. Install Work according to Municipality of Stinson BeachPublic Works standards.

3.3 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.

1. During non-germinating periods, apply mulch at recommended rates.
2. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 329219 permanent seeding specifications.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

C. Field test concrete in accordance with Section 032000.

D. Compaction Testing: In accordance with ASTM D1557 and ASTM D3017.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

F. Frequency of Compaction Testing: One for each lift.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.

C. Do not damage structure or device during cleaning operations.

D. Do not permit sediment to erode into construction or site areas or natural waterways.

E. Clean channels when depth of sediment reaches approximately one half channel depth.

3.6 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

C. Do not permit construction traffic over paving 7 days minimum after finishing.

D. Protect paving from elements, flowing water, or other disturbance until curing is completed.

END OF SECTION 31 25 00

SECTION 316213 - CONCRETE PILES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate Work with that of all other trades affecting or affected by the Work of this Section. Cooperate with such trades to assure the steady progress of all Work under the Contract.

1.2 DESCRIPTION OF WORK

A. Work to be done under this Section includes, but is not limited to, providing all labor, materials, equipment, and services as necessary and incidental to the proper execution of the Work as shown on the Drawings and as specified herein.

1. Furnishing and installing 67 kip allowable design capacity in compression (550 kip ultimate capacity and includes 450 kip allowance for downdrag) and 18 kip allowable design tension capacity (55 kip ultimate capacity) and 18 kip allowable lateral capacity, 14-in.-sq. precast-prestressed concrete (PPC) friction piles at the locations and to the lines and grades shown on the Drawings.
2. Providing reinforcing steel or other connection as shown on the Drawings to connect piles to pile caps. Required seismic reinforcement shall be provided in accordance with Code requirements.
3. Propose pile installation equipment, driving energy and installation criteria, and conduct computer wave equation analyses by WEAP (Wave Equation Analyses for Piles) prior to mobilization and import of indicator pile program materials to the site, to demonstrate that the proposed hammer and driving system delivers the required energy per blow to the pile to achieve the required capacity, and that driving stresses in the piles with the proposed hammer-pile-soil interactions will not exceed the allowable tensile and compressive stresses, or otherwise damage, the piles during driving.
4. Modify (as appropriate) and propose final pile installation criteria and, if required by the COR, modify computer wave equation analyses by WEAP (Wave Equation Analyses for Piles) prior to mobilization and import of production pile materials to the site and after completion of the indicator program to demonstrate that the selected installation system and criteria deliver the required energy per blow to the production pile and achieve the required capacity.
5. Installation of a minimum of 5 percent of the total proposed production pile locations shall be indicator piles. Locate indicator piles at approved production locations to aid in evaluating pile installation conditions, performance of the pile driving equipment, and confirmation of design capacity. Perform Dynamic Pile Testing for all of the indicator piles.

6. Conducting 48-hour re-strikes of all indicator piles using PDA equipment to determine pile setup/relaxation characteristics of the bearing strata. Perform CAPWAP analyses on all the indicator piles after initial driving and restrikes.
7. If pile equipment is changed during production installation Dynamic Pile Testing shall be performed on the first two (2) production piles at no cost to the Owner. The new pile equipment shall have comparable characteristics and comparable ENTHRU energy as measured by the PDA.
8. Pile shall be spliced as required with required splice working capacity (using factor of safety of 2) to transfer vertical (compression and tension), moment, lateral loads between pile lengths.
9. A Pile Load test will not be required for piles designed and installed in accordance with the criteria defined herein. Should the Contractor propose an alternate pile, a load test may be required.
10. The Contractor shall pre-excavate through the limits of the Miscellaneous Fill at pile locations to clear and or remove obstructions. The Contractor may elect to perform probing, pre-drilling or spudding at pile locations.
11. Cutting-off and legal off-site disposal of pile stick-ups to achieve the design cutoff elevation, following installation of piles to the required embedment in the bearing stratum, and removal from the site. Expose steel strands and provide other connections where called for on the Drawings.
12. Provide and maintain survey control for layout of design pile locations, pile heave measurement, preparation of as-built sketches, and related survey control Work.
13. Perform and sequence Work, and maintain equipment in good condition to minimize noise and vibration caused by pile installation activities.

1.3 RELATED SECTIONS

A. Division 31 – Earthwork

B. Section 31 62 19 – Timber Piles

1.4 DEFINITIONS AND REFERENCE STANDARDS

A. ACI: American Concrete Institute.

B. ASTM: Specifications of the American Society for Testing and Materials.

C. Contractor: The entity responsible for performing the Work of this Section.

D. Code: International Building Code (2021 edition)

E. Owner: National Park Service

F. COR: Authorized representatives of the Owner.

G. PCI: Prestressed Concrete Institute

1.5 QUALITY ASSURANCE

A. Comply with all rules, regulations, laws and ordinances of the State of California and of all other authorities having jurisdiction. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.

B. Field Monitoring and Testing

1. Full-time monitoring of pile driving operations will be provided by the special inspector in accordance with the Code. No piles shall be driven or tested except in the presence of the special inspector.
2. Pile driving records will be prepared and maintained by the special inspector. The Contractor may elect to maintain his own records and typically include the following information:

   a. Project name and number.
   b. Name of contractor.
   c. Pile location and number.
   d. Design pile capacity.
   e. Type and size of hammer used.
   f. Type of pile driving cap used.
   g. Rate of operation of pile driving equipment.
   h. Pile dimensions.
   i. Elevation of tip.
   j. Elevation of butt before and after cutoff.
   k. Ground elevation.
   l. Record of number of blows for each foot of penetration
   m. Pile location deviation.
   n. Pile uplift and re-drive information (if required)
   o. Unusual occurrences during pile driving.
   p. Type, size, length, and structural design of followers used.

C. The Contractor shall provide the special inspector with survey data as required in these specifications, including but not limited to elevation of pile butt before and after cutoff, elevation of pile tip, pile heave measurements and re-drive information..

D. The Contractor or his pile supplier shall provide daily quality control of concrete and other materials for pile manufacture at the plant. From time to time, the special inspector or COR may visit the plant to observe pile manufacture. The Contractor shall fully cooperate with the Testing Agency or special inspector to facilitate observing and assisting in taking and storing samples.

E. Certification of quality and source of pile materials to be used in the Work shall be furnished, in a form acceptable to the Designer, at the time of delivery of materials to the site. Piles shall not be delivered to the site without documentation of casting location, date and time, and material strength. Pile materials shall also be subject to on-site observation for conformance with specifications.

F. Approvals given by the special inspector or COR shall not relieve the Contractor of his responsibility for performing the Work in accordance with the Contract Documents, nor shall

they be construed to relieve the Contractor from full responsibility for the means and methods of construction and for safety on the construction site.

G. The Contractor shall employ a Professional Engineer currently registered in the State of California (Registered Professional Engineer) who specializes in geotechnical engineering to perform wave equation (WEAP) analyses with the Contractor's proposed pile driving hammer and system to install piles to depths required without overstressing the pile section during driving. The Registered Professional Engineer shall have not less than 5 years' experience within the last 10 years in making consulting engineering recommendations, design, or supervising installation of pile foundations, and shall have completed wave equation analyses on not less than five unrelated, independent projects, in which piles were successfully installed.

H. Qualifications of Contractor

1. Shall have at least 3 years of experience within the last 10 years in pile driving of similar type and complexity as the specified pile foundations.
2. Shall have completed not less than three successful pile foundations of similar type and complexity as the indicated pile foundations within the last year.
3. Shall employ a Land Surveyor or Professional Engineer Registered in the State of California with experience in survey control for projects of similar type and complexity, including preconstruction layout of building columns and determining as-built locations and elevations of driven piles.

1.6 SUBMITTALS

A. General

1. The Contractor shall conform to all submittal requirements of the Contract including submitting the information specified herein to the COR for review. All submittals shall be stamped by a Professional Engineer registered in the State of California.
2. The Contractor shall adhere to the Submittal Schedule described in the Contract General Conditions and herein. The Contractor shall make every effort for timely submissions, leaving adequate time for the COR to review, evaluate and respond to the Contractor. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the Work.
3. The Contractor shall submit a driving plan and schedule/sequence for installation of the piles.
4. Unless otherwise noted, the Contractor shall forward submittals to the COR a minimum of 2 weeks prior to any planned Work related to the Contractor's submittals. No Work shall be started until the necessary review and approvals have been given.

B. Shop Drawings

1. Shop drawings showing sizes, tip, joint or splice details, welding, reinforcing, pick up points and other items pertinent to pile manufacturing, design and handling. Drawings shall be stamped by a Registered Professional Engineer.
2. A scaled drawing indicating design pile locations relative to building column lines, with each pile labeled with a sequential designation proposed by the Contractor, scale 1 in. = 20 ft.

3. Proposed dynamic testing equipment setup including details of equipment and apparatus to be used, proposed locations and procedures for dynamic testing, calibration data, and other supporting literature. This item shall be submitted a minimum of 3 weeks prior to mobilizing dynamic testing equipment to the site.

C. Pile Driving:

1. Manufacturer's literature, including technical and performance literature for pile driving hammer, cushions, and other equipment for piles.
2. Details of equipment and procedures for pre-excavation.

D. Wave Equation Analysis and Driving Stresses

1. Qualifications and experience of Contractor's Engineer performing the wave equation analyses.
2. The Contractor shall propose a final driving criteria (blow count) as the minimum number of hammer blows per each inch of penetration for the final 6 in. of pile penetration in the bearing stratum to achieve the ultimate capacity. The proposed criteria shall be submitted to the COR for review and acceptance. Piles shall not be installed prior to acceptance of the criteria by the COR.
3. Results of wave equation analyses performed and stamped by a Registered Professional Engineer in the State of California, which demonstrate that the equipment, cushions and cap are capable of obtaining the required pile load capacity without damage to the pile due to driving stresses. A minimum of two wave equation analyses for each capacity and pile driving system proposed by the Contractor shall be submitted to the COR depicting the variation in subsurface conditions across the site. The wave equation analyses shall model bearing conditions in soil and anticipated pile lengths across the site and at a minimum shall consider the following:
   a. The maximum allowable compressive stress in PPC piles during driving shall not exceed 0.85f'c – f'pc, where f'pc is the effective prestress.
   b. The maximum allowable tensile stress in PPC piles during driving shall not exceed 3(f'c)1/2+f'pc.

E. Pile Design

1. Installation lengths and embedment in bearing stratum.
2. The concrete mix design including cement type and source, and any additives.
3. With each delivery of PPC piles, results of concrete strength tests conducted by a certified laboratory on samples cured in the same environment as the piles. No piles will be accepted unless accompanied with delivery by concrete strength data.

F. Pile Dynamic Testing

1. The Contractor shall submit their means and methods for the installation and monitoring of indicator piles (five percent of production piles shall be indicate piles). Submit typical output results (including Case Method and CAPWAP interpretations of capacity) for the COR to review prior to performing dynamic testing. If further data are necessary, the Contractor shall modify the equipment and procedures as necessary to obtain such data during driving, including additionally tested piles as required by the COR, at no additional cost to the Owner. The Contractor's Engineer shall submit a report providing the results of

the dynamic testing on production piles, to be submitted and approved prior to production pile delivery and installation.

G. Estimated Pile Lengths

1. The following information shall be submitted two weeks prior to production pile installation after careful review of the results of the indicator pile program:

   a. A tabular summary of anticipated pile lengths at each pile location indicated on the Contract Documents.
   b. Pile designation plan showing piles numbered sequentially (i.e., 1,2,3...)

H. As-Driven Pile Location and Survey Data

1. Submit sketch and tabular documentation of actual pile location in relation to the design location and survey data for heave checks of piles within the radius of uplift within 1 working day after each individual pile or pile cluster is completed.
2. Within 7 days after the completion of all pile driving, submit to the Owner a final as-driven pile location drawing (1 in. = 20 ft), certified by a Registered Land Surveyor or Registered Professional Engineer.
3. All drawings and sketches shall include the following:

   a. Column lines, north arrow and graphical scale.
   b. Each pile identified by a separate number, designated by the Contractor and submitted prior to pile driving.
   c. Elevation of each top of pile prior to and after cutting, to nearest 0.1 ft.
   d. Deviation in inches, to the nearest 0.25 in., from plan design location at cutoff elevation.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall deliver piles at times and in sequence to assure continuity of pile driving.

B. Piles shall be handled, transported, stacked and protected to prevent damage.

C. Lifting points shall be clearly marked on the piles by the manufacturer, and all handling and storage shall be undertaken with consideration for required support.

D. Piles shall be picked up into the leads by the designated lifting points.

E. Piles shall be clearly marked with the length of the pile prior to delivery.

1.8 LINES AND GRADES

A. The Contractor shall stake the locations of the foundations and establish all elevations required. A baseline and permanent benchmark that easily allows the survey to be re-established shall be located on or close to the site. The Contractor shall provide stakes at design pile locations. The Contractor shall be responsible for the maintenance and protection of the baseline and benchmark, and all location stakes.

B. The Contractor shall employ a licensed Registered Land Surveyor or a Registered Civil Engineer, familiar with pile installation, who shall establish lines and levels. The Contractor shall be responsible for the correct location of piles, as well as keeping up-to-date records of the amount of individual pile heave, and establishing actual pile locations. The Contractor shall also be responsible for the protection of any baselines, benchmarks, and all pile location stakes.

C. Survey equipment for pile installation shall have the capability of measurements accurate to $1/16^{th}$ of an inch.

1.9 JOB CONDITIONS

A. Subsurface data on soils, groundwater, and environmental quality of fill soils is provided in the Report titled "Design Level Geotechnical Investigation Report, Stinson Beach Lifeguard Tower and Visitor Snack Bar Replacement, Marion County, California", dated 17 January 2024, prepared by Haley & Aldrich Inc. The report is available from the COR.

B. Prior to submitting the bid, the Contractor shall review and understand all the available subsurface data, including soil conditions, groundwater conditions, remaining underground foundations, utilities, etc. The geotechnical and environmental information is made available to the Contractor for information on factual data only and shall not be interpreted as a warranty of subsurface and environmental conditions whether interpreted from written text, test boring logs, laboratory chemical data or other data.

C. The Contractor shall draw his own conclusions regarding site conditions based upon site history, Contractor site observations, and from available sources, for which the Owner and its Consultants assume no responsibility. The Contractor shall assume that subsurface conditions between subsurface explorations could differ from conditions shown in the records of the explorations.

D. The Contractor shall protect nearby structures (above ground and buried) from damage or disruption of normal activities associated with the pile driving and other operations. Damage due to pile driving or other Contractor activities shall be repaired by the Contractor at his own expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pile types and minimum dimensions shall be sufficient for design capacity piles indicated on the Drawings and in accordance with the requirements herein and the Code.

B. Pile materials shall be new and of uniform quality. Manufactured or assembled pile materials shall be of sufficient strength and rigidity to withstand all handling and driving stresses.

C. Piles shall be furnished in sufficient lengths to meet specified driving and all other requirements.

2.2 PRECAST-PRESTRESSED CONCRETE PILES

A. Piles shall be square precast-prestressed concrete piles with 14-in. minimum side dimensions. All precast concrete piles shall be designed, reinforced, and manufactured in accordance with current standards of the Joint Committee of AASHTO, PCI and the California State Building Code. Hollow core piles will not be accepted.

B. Concrete for precast piles shall have minimum compressive strength of 5,000 psi at 28 days. The maximum water/cement ratio shall not exceed 0.40. The minimum cement content shall be 7 bags per cubic yard. No precast concrete piles shall be delivered to site before concrete has attained a compressive strength of 4,000 psi, based on tests of cylinders cast from same batches and cured under same conditions as pile concrete. Provide the COR with each delivery, documentation in acceptable form indicating that concrete used in piles had attained minimum compressive strength of 4,000 psi, prior to delivery of piles to site, and that the piles conform to PCI and AASHTO requirements. Pile materials shall also be subject to on-site inspection for conformance with specifications. Regardless of concrete strength data, no piles shall be delivered to site until they are at least 72 hours old.

C. If, for any reason, a pile is damaged or reinforcing steel is exposed, its use shall not be allowed. The minimum concrete cover of the reinforcing steel shall be 3 in.

D. Lateral reinforcing at both ends of pile shall be spaced sufficiently close to resist impact stresses due to driving and in no case more than 3-in. on-center. Lateral reinforcing for piles shall also conform to the requirements of the California State Building Code. Top of pile must be perpendicular to longitudinal axis of pile, and ends of any prestressing or reinforcing steel shall be cut flush with top of pile to prevent direct impact on steel during driving.

E. Length of piles to be ordered shall be determined by the Contractor. Ordering and delivery of piles shall be planned in such a manner that changes in length of piles for piles not yet manufactured may be made if driving experience, as Work progresses, indicates need for such changes.

F. Precast piles shall be cast with a steel bottom plate. The plate shall have a minimum thickness of 1-1/2 in., have the same lateral dimensions as the pile, and shall be attached to the pile with dowels as indicated in the AASHTO-PCI standards. Dowels shall extend into the pile a minimum distance of 3 ft.

G. Concrete for precast piles shall be type II Portland Cement, and contain a maximum tricalcium aluminate (C3A) content of eight (8) percent and a minimum of seven bags of cement per cu. yd. Upon delivery of the piles to the site, provide the COR with certificates indicating that the tricalcium aluminate content conforms to this requirement.

H. Install dowels in the tops of the piles or expose pile reinforcement strands as indicated on the Drawings.

I. Prestressing steel shall be 7-wire low relaxation strand conforming to the requirements of ASTM A416, Grade 270. Piles shall have a minimum effective prestress of 700 psi.

J. Special Requirements for Pile Cap Seismic Connection: The Contractor shall provide the Code required seismic reinforcing for the full length of the pile section.

2.3 REINFORCING STEEL

A. Reinforcing strands shall have a minimum ultimate strength of 270 ksi, as per ASTM A416.

B. Piles shall also be designed with seismic reinforcement as outlined in the Building Code, Section 1810.3.8.

C. Spiral reinforcing for piles: ASTM A615, grade 60 plain bars, or ASTM A82 smooth wire, except that for wire with F_y over 60,000 psi, the F_y shall be the stress corresponding to strain of 0.35 percent.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATIONS AND EQUIPMENT REQUIREMENTS

A. The Contractor shall provide the necessary pile driving equipment for full-time operation at the site during the Work to complete the Work on schedule. The Work will require the mobilization of crane mounted equipment for installation of the indicator and the production piles.

B. Prior to production driving, the Contractor shall install with Dynamic Testing indicator piles (for a minimum of 5 percent of production pile locations) for each type/capacity of production pile location across the site at locations designated by the COR to aid the Contractor in evaluating driving conditions and to evaluate hammer performance, and acceptable driving stresses. Piles shall be installed in accordance with the Contractor's proposed hammer and installation criteria defined herein, as approved by the COR. Indicator pile locations shall be determined by the COR.

C. The Contractor may elect to drive more than the required minimum number of indicator piles at the Contractor's election only if approved by the COR, at no additional cost to the Owner.

D. No piles shall be installed within 30 ft of concrete less than 24 hours old.

E. The Contractor shall coordinate his pile driving operations with other Work on the site.

F. If, at any time during production pile driving, the Contractor proposes to change the pile-driving system (including the individual hammer or hammer type), which is different from the equipment used to install the indicator piles, additional dynamic testing shall be performed as required by the COR at the Contractor's expense.

3.2 DYNAMIC TESTING

A. Indicator piles shall be driven by the Contractor using the proposed pile driving equipment to the proposed final driving criteria proposed by the Contractor as supported by the Contractor's approved Wave Equation Analyses. During driving of the indicator piles, the Contractor will conduct pile dynamic testing on all indicator piles. The data obtained will be used by the COR to evaluate hammer performance and acceptable driving stresses. The Contractor shall also perform a restrike at least one day following end-of-drive to confirm CAPWAP capacity of the pile.

B. If, based on the results of dynamic monitoring, the COR determines the hammer is not working adequately, the hammer will be rejected and a replacement hammer shall be supplied by the Contractor. All previously driven piles shall be re-driven and the Dynamic testing repeated at no additional cost to the Owner.

C. If, at any time during production pile driving, the Contractor proposes to change the pile installation equipment (including the individual hammer or hammer type), which is different from the equipment used to install the indicator piles, pile dynamic testing shall be performed by the COR with assistance by the Contractor at the Contractor's expense.

3.3 EQUIPMENT

A. Piles shall be installed with approved modern equipment in good working order. The proposed pile installation equipment and methods shall be subject to approval of the COR and approval shall be secured before the start of installation.

B. The leads of the pile driving rig shall be fixed at two points; the points shall be at least half the length of the leads apart in order to maintain the pile and hammer in axial alignment at the correct plan location during the entire driving operation. The leads shall extend down to the lowest point at which the hammer must operate.

C. Piles shall be driven with a variable speed single acting hydraulic hammer delivering a transferred energy to the pile top (ENTHRU) of 36,000 foot-pounds of energy per blow. During production driving the same stroke shall be used.

D. An aluminum micarta cushion block, or other cushion material if approved by the COR, shall be used in the hammer for driving piles. In addition, a laminated wood cushion block 4 to 8 in. in thickness shall be used directly on the butts of PPC piles to protect the pile from damage during driving. Both cushions shall be replaced when burned, smoking, or otherwise worn.

E. The pile-driving cap for driving PPC piles shall be designed to allow the pile to rotate during driving and to protect dowels or other anchorage devices from damage.

F. Hammers used to drive production piles shall be the same physical equipment used to install indicator piles.

G. The use of followers will not be permitted unless authorized in writing by the COR.

3.4 INSTALLATION

A. Removal of Obstructions

1. If obstruction(s) are encountered during pretrenching at pile locations, the obstruction(s) shall be removed by excavation, pre-drilling, or other approved method. No claim shall be made or allowed for delays or any costs or damages associated with obstructions or their removal.

2. Details of pre-excavation, predrilling, and prespudding equipment and methods shall be submitted to the COR for review and approval, at least 2 weeks prior to beginning the Work.
3. If a pile location is determined to be obstructed as defined herein, and cannot be successfully cleared by excavating, the Contractor shall immediately notify the COR who shall determine whether the pile location is to be moved or additional piles installed. If directed by the COR, the Contractor shall attempt to remove and redrive any undamaged, obstructed pile after an obstruction has been removed.
4. Piles directed by the COR to be abandoned because of obstructions or other unacceptable defects encountered shall be cut off at least 1 ft below design cut-off elevation and left in place.

B. Splicing

1. A maximum of one splice per pile will be permitted using the splicing system approved by the COR and the methods recommended by the Manufacturer. No splices will be permitted within 30 ft. of the pile cutoff or pile tip.
2. The strength of all splices, in compression, tension and bending, shall be equal to or greater than the ultimate capacities of the pile section.
3. Piles may be spliced in the leads. The sections of piles to be spliced shall be secured in alignment such that there is no eccentricity between the axes of the two spliced lengths, or angle between them, after the splice has been completed.
4. Welds which do not conform to specifications shall be gouged and repaired as directed by the inspector.
5. Mechanical drive-fit splices shall not be used without acceptance by the COR.
6. Unless waived by the COR, the Contractor shall test the proposed splice. Splicing and testing shall be done in the presence of the COR. Testing shall be completed, to the satisfaction of the COR, prior to the start of production pile driving. A minimum of six tests shall be conducted, consisting of a minimum of two tests each in compression, tension and bending. Tests shall be conducted on full scale splices, which are constructed in a manner identical to the proposed for use on the project. Tests shall be conducted using calibrated equipment to monitor load and deflection. The Contractor shall submit results of the tests, certified by an approved testing agency, to the COR. Test results shall include calculations based on the test data, of the capacity of the splice in compression, tension and bending made by a Professional Engineer registered in the state of California. The splice will be approved provided that at least two tests each in compression, tension and bending demonstrate that the capacity of the proposed splice is equal to or greater than the ultimate capacity of the pile. Prior to the start of testing, the Contractor shall submit the proposed testing methods to the COR for review and approval.

C. Driving

1. As part of preparation for driving, each pile shall be marked at 1-ft intervals along the entire pile length. In addition, the footage shall be marked and designated at 5-ft intervals, starting from the tip of the pile.
2. All piles shall be driven at the indicated locations, orientations and batters. The Contractor shall utilize a pile alignment system such as templates or other measures to position the piles in accordance with the Drawings. Pile location, orientation and batter shall be checked during driving and appropriate measures taken, as necessary, to maintain the correct pile position.

3. Each pile shall be driven to bearing in the alluvium soils to the required minimum design capacity in compression using the accepted final pile driving criterion. Minimum embedment in the bearing soils shall be 75 ft. Pile driving shall be continuous and without interruption except as required for splicing. Pile driving shall be terminated when the accepted final embedment is achieved.
4. Pile driving resistance shall be constant or increasing during achievement of the final driving criterion.
5. During pile driving, the maximum compressive and tensile stresses in the piles shall not exceed the allowable stresses
6. When driving piles through soft soils or in pre-augured or probed holes, the hammer ram velocity at impact shall be reduced to avoid cracking due to tensile stresses in the piles.
7. Immediately after a pile in a pile group is driven, the Contractor shall establish a reference point and its elevation on the pile for the purpose of checking heave of the pile tip as additional piles are driven.
8. After all piles within the radius of heave have been driven, the Contractor shall determine the elevation of the reference points on each of the piles in the group.
9. The radius of heave shall be initially assumed to be the zone within 30 ft of piles driven within a given day. This radius may be expanded or contracted by the COR based on actual field measurements and is defined as the maximum distance between piles such that pile driving causes uplift of 0.04 ft or more in the affected pile.
10. By the end of each day of driving of piles, the Contractor shall determine the elevation of the reference points on each of the piles within the radius of heave. If heave of 0.04 ft or more has occurred on any pile within the radius of heave, the Contractor shall report those results to the COR so that a determination may be made on which piles shall be re-driven to their original elevation before the end of the shift. Piles may be re-driven deeper, if necessary, to the final driving criterion. After re driving each pile, the Contractor shall re-establish the elevation of the reference point. Re-driving shall be repeated as often as necessary until the measured heave on any pile is less than 0.04 ft.
11. Piles in a group shall be driven commencing in the center of the group and working toward the edge. All piles in any group shall be driven before moving to other locations.

D. Obstructions

1. Obstructions are defined as any man-made or man-placed objects below ground surface that prevent installation of piles at the design locations and to the required depths. Pre-excavation through the fill is required per Division 31. Obstructions in the fill shall be removed by the Contractor at no additional cost to the Owner.
2. The Contractor shall make reference to the available subsurface information regarding site conditions.
3. The Contractor shall pre-excavate through the fill material at pile locations for removal of obstructions if encountered in the fill. Excavated material may be used as backfill after removal of obstructions.
4. The Contractor may at his option pre-auger or probe pile locations to locate obstructions prior to pile installation, at no additional cost to the Owner.
5. If a pile is obstructed as defined herein, the Contractor shall immediately notify the COR who shall determine whether the location is to be excavated or if the pile(s) shall be moved or additional piles installed. If required by the COR, the Contractor shall attempt to remove and re-drive the undamaged, obstructed pile after the obstruction has been removed, at no additional cost to the Owner.
6. Where obstructions make it impossible to install certain piles to the required depth, and is not within the fill material, the obstruction may be removed by others by excavation. If

the COR determines that additional piles are required, in lieu of obstruction removal by excavation or other procedures, the Contractor will be reimbursed for the additional pile(s) ordered by the COR.

7. Piles required by the COR to be abandoned because of damage or other violation of the Specifications shall be cut off at least 2 ft below design cutoff elevation and left in place. Replacement piles shall be installed at locations determined by the COR, at no additional cost to the Owner.

E. Cutting Off Piles

1. Pile tops shall be cut off square within one 1 in. of the elevations shown on the Drawings. The pile cutoffs shall become the property of the Contractor and shall be removed from the site
2. Pile build-ups will not be permitted. Piles driven below the design elevation shall be cutoff a minimum of 1 ft below the design bottom of the pile cap and abandoned at no cost to the Owner. Such additional piles shall be driven as required by the COR, at no additional cost to the Owner.

3.5 TOLERANCES AND CRITERIA FOR ACCEPTANCE

A. Piles shall be installed to the following tolerances

1. Piles shall be driven as close as practicable to the plan location.
2. A maximum permissible lateral deviation from the design location measured in any direction at cutoff elevation equal to 1.5 in. for single piles and groups of two piles.
3. A maximum permissible lateral deviation from the design location measured in any direction at cutoff elevation equal to 3 in. for each pile within groups of three or more piles.
4. A maximum deviation from design cutoff elevation equal to 1 in. shall be permitted.

B. Plumbness: The pile plumbness, as measured on the projection of the pile above ground, shall not deviate by greater than 5 percent from the vertical alignment.

C. Piles that are damaged below cutoff elevation during driving will be rejected. If, upon comparing pile performance during driving with that of other driven piles, and evaluating subsurface conditions, the COR determines that a pile has been unacceptably damaged, the COR may reject the pile.

D. Piles indicating sudden or peculiar decrease in penetration resistance during driving will be assumed to be broken and will be rejected unless the COR's review of available data indicates that sudden decrease in driving resistance is due to natural subsurface conditions and continued acceptable driving behavior is observed.

E. Except as suitable under "Obstructions", piles that are rejected because of damage, mislocation or misalignment, or failure to meet the driving criteria or other requirement of these specifications, shall be cut off 2 ft below the limits of the structure and abandoned, and additional piles shall be driven as directed by the COR at no additional cost to the Owner.

F. When otherwise acceptable, installed piles exceed the specified tolerances, the Contractor shall provide an accurate survey to the COR, as specified. The COR will then analytically determine the total loads on individual piles, based on this survey. If the load on any pile

exceeds 10 percent of the specified design load capacity, corrections shall be made by adding piles, or other procedures, in accordance with a design provided by the COR.

G. The installation of replacement piles and other corrective measures shall in all cases be in accordance with designs provided by the COR.

H. Any increased costs for redesign and for construction caused by rejected piles or piles exceeding tolerances shall be the responsibility of the Contractor.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Piles will not be measured for payment.

B. Standby time, authorized in advance by the COR, due to obstruction removal by others, will be measured on a per-hour basis as the time in excess of 1.0 hour per pile required to remove obstructions.

C. Should an alternate to the specified pile be proposed by the Contractor and Pile Load Test determined to be required by The COR the Load Test will be measured by successfully completed test in accordance with ASTM Standards and the Code.

4.2 BASIS OF PAYMENT

A. Work under this contract shall include the total base bid (Contract) price for installation of the required number of piles. The Work shall include furnishing and driving indicator and production piles, cutting off new piles to specified grades, stockpiling cutoffs at the site, and mobilization and demobilization, which shall include job setup, moving equipment including pile driving rigs on and off the project, establishing and dismantling the Contractor's field administration forces and equipment, and all other Work incidental to supplying and installing the piles.

B. Precast concrete pile installation shall include the total bid price for the installation of the piles.

C. Final payment shall be based upon the completion of piles driven and accepted below design cutoff in accordance with this Section. If the total number of piles is over or under the base quantity, the additional piles shall be paid to the Contractor or the deducted piles shall be credited to the Owner on the basis of the unit prices quoted in the Contract.

D. No separate payment will be made for pre-augering or probing pile locations to locate or remove obstructions prior to pile installation.

E. Authorized stand-by time due to obstruction removal by others will be paid at the hourly rate quoted in the Contract.

F. Piles damaged or rejected for non-compliance with these Specifications, for any reason, will not be paid for.

G. Piles rejected or damaged by confirmed obstructions that are not within the fill layer in the judgment of the COR, will be paid on the basis of the unit prices quoted in the Contract. Additional piles installed to replace or compensate for obstructed piles shall be installed and paid for on the basis of the unit price quoted in the Contract.

H. Whenever, in the judgment of the COR, misalignment or rejection of a pile or piles, caused by the Contractor's violation of the specifications or his other non-performance, necessitates structural redesign, the cost of such redesign shall be deducted from sums otherwise due to the Contractor under the Contract. If the redesigned pile cap requires greater quantities of concrete and reinforcing steel, as compared with the quantities required for the pile cap as originally designed, the additional cost for pile cap concrete, reinforcing steel and form Work shall also be deducted from the Contract price.

I. No separate payment will be made for pile cutoffs.

J. If required: Payment for Pile Load Test will be made per successfully completed test proving the pile design capacity.

K. Unit Pricing.

Item	Description	Quantity	Unit Price
316213-1	Furnish and install 67 kip allowable design capacity in compression, 18 kip allowable design tension capacity and 18 kip shear PPC friction piles and indicator piles	Not Measured	Lump Sum
316213-2	Add/Deduct piles	-	$_____/Ea
316213-4	Standby Time	-	$_____/Hr
316213-5	Pile Load Test	1	$_____/Ea

END OF SECTION

SECTION 31 62 19 - TIMBER PILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Special Conditions and DIVISION I - GENERAL REQUIREMENTS, apply to the work of this Section.

B. Examine all Drawings and all other sections of the specifications for requirements therein affecting the work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

A. The work of this Section includes all labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. For piles at dining deck install 15-kip allowable design capacity friction timber piles in compression allowable design capacity in tension and 1-kip allowable design lateral capacity for a 12 in. minimum butt diameter (10-in tip) treated timber piles at the locations and to the lines and grades shown on the Drawings. Refer to the subsurface data from the Geotechnical Report titled “Design Level Geotechnical Investigation Report, Stinson Beach Lifeguard Tower and Visitor Snack Bar Replacement dated 17 January 2023. Timber Piles shall be treated in accordance with the Code and have a minimum design life of 100 years.
2. For piles at wood retaining walls and boardwalk provide 6x6 or 8x8 timber piles as shown on plan.
3. Comply with all federal, state and local regulations relative to pile installation work.
4. Cut-off of pile stick-ups at design cut-off elevation and dispose of in accordance with local, state and federal regulations.
5. Provide and maintain survey control, and provide layout of design pile locations, pile heave measurement, preparation of as-built sketches, and related survey control work.
6. Installation of a minimum of two indicator piles at approved production pile locations to aid in evaluating the pile installation conditions and performance of the pile driving equipment.
7. For piles installed in accordance with the criteria specified, it is not anticipated that a load test will be required. Should the Contractor propose an alternate pile, a load test may be required.

1.3 RELATED SECTIONS

A. Division 31 – Earthwork

B. Section 31 62 13 –Concrete Piles

1.4 REFERENCE STANDARDS

A. ASTM: Specifications of the American Society for Testing and Materials, latest edition.

B. AWPA: Specifications of the American Wood – Preservers' Association Standard, latest edition.

C. Code: International Building Code (2021 edition)

1.5 QUALITY ASSURANCE

A. Comply with all rules, regulations, laws and ordinances of the State of California and all other authorities having jurisdiction. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.

B. Field Monitoring and Testing:

1. Full time monitoring of pile driving operations will be provided by a special inspector. No piles shall be driven except in the presence of the special inspector.
2. Pile driving records will be prepared and maintained by the special inspector and include the following information:

a. Project name and number.
b. Name of Subcontractor.
c. Pile location and number.
d. Design pile capacity.
e. Type and size of hammer used.
f. Type of pile driving cap used.
g. Rate of operation of pile driving equipment.
h. Pile dimensions.
i. Elevation of tip.
j. Elevation of butt before and after cut-off.
k. Ground elevation.
l. Record of number of blows for each foot of penetration, and final penetration resistance.
m. Unusual occurrences during pile driving.
n. Type, size, length, and structural design of followers used.

C. Certification of quality and source of pile materials to be used in the work shall be furnished, in a form acceptable to the special inspector, at the time of delivery of materials to the site. Pile materials shall also be subject to onsite inspection by the special inspector for conformance with specifications.

D. Approvals given by the special inspector or COR shall not relieve the Contractor of his responsibility for performing the work in accordance with the Contract Documents, nor shall they

be construed to relieve the Contractor from full responsibility for the means and methods of construction and for safety on the construction site.

E. The Contractor shall employ a Professional Engineer registered in the State of California who specializes in geotechnical engineering to perform Wave Equation Analyses for the pile driving system proposed by the Contractor. The Registered Professional Engineer shall have not less than ten years' experience within the last 20 years in making consulting engineering recommendations, design, or supervising installation of pile foundations, and shall have completed wave equation analyses on not less than five unrelated, independent projects, in which piles were successfully installed using the pile driving criteria obtained from the wave equation analyses.

1.6 SUBMITTALS

A. General:

1. The Contractor shall adhere to the Submittal Schedule described in the Contract Documents, making every effort for timely submissions and leaving adequate time for the COR to review, evaluate and respond to the Contractor. The Contractor is responsible for scheduling specified submittals and re submittals so as to prevent delays in the work.
2. The Contractor shall submit the information specified herein to the COR for review. Unless otherwise specified, submittals shall be made not less than two weeks before the start of the work. No work shall be started until the necessary review and approvals have been given.

B. Shop Drawings:

1. Shop Drawings showing pile sizes, pile tip, pick up points, pile treatment with preservatives, pile cap connection, and other items pertinent to pile design and handling.

C. Pile Driving Equipment:

1. Manufacturer's literature, including technical and performance literature for pile driving hammer(s), cushions, and other equipment for piles.

D. Pile Preparation Installation:

1. Design and record of implementation of the wood preservative in accordance with AWPA U1 (per the Code).

E. Wave Equation Analyses and Pile Lengths:

1. Qualifications and experience of Contractor's Engineer performing the wave equation analyses.
2. Results of wave equation analyses, performed and stamped by a Registered Professional Engineer in the State of California, retained by the Contractor, which demonstrate that the

equipment, followers, cushions and cap are capable of obtaining the required pile load capacity in accordance with the Code without damage to the pile due to driving stresses.

3. The Contractor shall provide at the completion of pile driving operations and at least 5 days prior to removal of pile driving equipment from the site, a final As-Driven pile location plan, indicating surveyed location, pile designation, tip elevation, and cutoff elevation, certified by a registered Land Surveyor in the State of California.

F. As-Driven Pile Location Data

1. Submit sketch and tabular documentation of actual pile location in relation to the design location within 1 working day after each individual pile or pile cluster is completed.
2. Within 7 days after the completion of all pile driving, submit to the Owner a final as-driven pile location drawing, certified by a Registered Land Surveyor or Registered Professional Engineer.
3. All drawings and sketches shall include the following:
    a. Column lines, north arrow and graphical scale.
    b. Each pile identified by a separate number, designated by the Contractor and submitted prior to pile driving.
    c. Elevation of each top of pile prior to and after cutting, to nearest 0.1 ft.
    d. Deviation in inches, to the nearest 0.25 in., from plan design location at cutoff elevation.
    e. As-Built Record Drawings.
4. For day of driving of piles, the Contractor shall submit the elevation of the reference points on each of the piles within the radius of heave. If restrikes are necessary after initial driving of the pile, the Contractor shall submit re-established the elevations of the reference point. In addition to notification of the COR of heave data before the conclusion of each work shift, heave data shall be formally submitted for review within 24-hours after the conclusion of each work shift of pile driving.

G. Pile driving records shall be prepared by the Contractor:

1. Pile location deviation.
2. Pile heave and re-drive information.
3. Unusual occurrences during pile driving.

1.7 JOB CONDITIONS AND TOLERANCES

A. Subsurface Soil and Groundwater Conditions:

1. Subsurface data on soils, groundwater, and environmental quality of fill soils is provided in the Report titled “Design Level Geotechnical Investigation Report, Stinson Beach Lifeguard Tower and Visitor Snack Bar Replacement, Marin County California”, dated 17 January 2024, prepared by Haley & Aldrich Inc. The report is available from the COR.

2. Prior to submitting the bid, the Contractor shall review and understand all the available subsurface data, including soil conditions, groundwater conditions, remaining underground foundations, utilities, etc. The geotechnical information is made available to the Contractor

for information on factual data only and shall not be interpreted as a warranty of subsurface and environmental conditions whether interpreted from written text, test boring logs, laboratory chemical data or other data.

3. The Contractor must draw his own conclusions regarding site conditions based upon a site visit and from available sources, for which the COR assume no responsibility. The Contractor shall assume that subsurface conditions between subsurface explorations could differ from conditions shown in the records of the explorations.

4. The Contractor shall expect to encounter remnants of abandoned structures such as utilities, foundations, wood piles, historic seawalls and bulkheads, and other buried structures during pretrenching and general excavation.

B. Potential Obstructions:

1. The Contractor is advised that the fill may contain obstructions, which may interfere with new foundation locations and require removal. The Contractor shall notify the COR immediately if obstructions are determined to conflict with proposed pile locations.

2. Cobbles and boulders within dense well-bonded soils or other competent, naturally-deposited soils will not be considered as obstructions.

C. Protection of Adjacent Property and Utilities:

1. The Contractor shall protect adjacent structures (above ground and buried) from damage associated with the pile driving and other operations. Damage due to pile driving or other Contractor activities shall be repaired immediately by the Contractor at his own expense.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall deliver piles at approved times and in sequence to assure continuity of pile driving.

B. Piles with treatment shall be handled, transported, stacked and protected to prevent damage.

C. Lifting points shall be clearly marked on the piles by the manufacturer, and all handling and storage shall be undertaken with consideration for required support.

D. Piles shall be clearly marked with the length of the pile prior to delivery.

1.9 LINES AND GRADES

A. Baselines and benchmarks located on or close to the site will be provided by the Owner. The Contractor shall be responsible for the protection of the baselines and benchmarks and shall install piles at the design locations utilizing the reference locations provided by the Owner. The Contractor shall identify all design pile locations.

B. The Contractor shall employ a licensed Registered Land Surveyor or a Registered Civil Engineer, familiar with pile installation, who shall establish lines and levels. The Contractor shall be responsible for the correct location of piles, as well as keeping up-to-date records of the amount of individual pile heave, and establishing actual pile locations. The Contractor shall also be responsible for the protection of any baselines, benchmarks, and all pile location stakes.

PART 2 - PRODUCTS

2.1 TREATED TIMBER PILES

A. Timber piles shall be at least at least 10 inches in tip diameter. The piles shall have an allowable design compression capacity of 15 kips.

B. Timber piles shall conform to the requirements of ASTM D25 and shall be cut from sound and live trees. Piles shall be free from any defects which will impair their strength or that will prevent proper driving. All piles shall be cut above the ground swell, shall have a uniform taper from butt to tip end, and shall be free of short kinks. A line from the center of the butt to the center of the tip must lie wholly within the body of the pile.

C. All piles shall be subject to inspection before or after shipment to the site, or both, at the option of the COR. Any pile that does not conform to all the requirements will be rejected.

D. The kind of timber to be used for treated piles shall be Pacific Coast Douglas Fir, and shall be pressure treated in accordance with AWPA U1 per the Code. Preservative treated timber piles shall be subject to a quality control program administered by an approved agency. All piles shall have not less than 1 inch of sapwood at the butt end for Pacific Coast Douglas Fir.

E. If, for any reason, prior to installation a pile is damaged, its use shall not be allowed.

F. Length of piles to be ordered shall be determined by the Contractor.

2.2 SPLICES

A. Full-length piles shall always be used. Splices are not permitted.

2.3 FOLLOWERS

A. Follower should be of steel and sufficiently rigid or stiff to assure adequate transmission of hammer energy to install the pile without damage or adverse stresses to the pile. The bottom of the follower should be formed like or fitted with a drive cap suitable for the timber pile and cushion assemblage.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATIONS AND EQUIPMENT REQUIREMENTS

A. The Contractor shall provide the necessary pile driving equipment for full time operation at the site during the work to complete the work on schedule. The work will require the mobilization of crane mounted equipment for installation of all piles.

B. The Contractor shall coordinate the pile driving operations with other work on the site.

3.2 EQUIPMENT

A. Piles shall be installed with approved modern equipment in good working order. The proposed pile installation equipment and methods of pile installation shall be subject to approval of the COR, and approval shall be secured before the start of installation.

B. Piles shall be driven with a single acting, double acting, or differential acting steam, diesel, hydraulic or air hammer, for the 15-kip design compression capacity pile. The Contractor shall maintain the boiler or air pressure recommended by the manufacturer and shall employ the proper size hose and connections. When the determination of final driving resistance is being made with a diesel hammer, the energy being delivered to the pile shall be determined as the product of the weight of the ram times the observed or equivalent stroke for open diesel hammers; for closed diesel hammers, the energy shall be that indicated by an output gauge calibrated to measure total hammer energy.

C. Cushion block material, for driving piles, will be approved by the COR. Cushions shall be replaced when burned or otherwise worn.

D. The use of followers will only be permitted upon authorization in writing by the COR.

3.3 INSTALLATION

A. Driving:

1. As part of preparation for driving each pile including the follower shall be marked at one-foot intervals along the entire pile length or as otherwise specified by the COR. In addition, the footage shall be marked and designated at five-foot intervals, starting from the tip of the pile.
2. All piles shall be driven at the indicated locations and orientations. The Contractor shall utilize a pile alignment system such as templates or other measures to position the piles at the correct location. Pile location and orientation shall be checked during driving and appropriate measures taken, as necessary, to maintain the correct pile position.
3. Each pile shall be driven to mobilize a minimum of 15 kips in design compression capacity.
4. During pile driving, the maximum compressive and tensile stresses in the piles shall not exceed the allowable stresses as provided in the Code. This condition shall also be demonstrated by the Contractor’s Wave Equation Analysis.

5. When driving piles through soft soils, the hammer ram velocity at impact shall be reduced to avoid damage of the pile due to tensile stresses in the piles
6. Splices will not be permitted.
7. Immediately after a pile in a pile group is driven, the Contractor shall establish a reference point and its elevation on the pile for the purpose of measuring heave of the pile tip as additional piles are driven.
8. The radius of heave shall be initially assumed to be the zone within 30 ft of piles driven within a given day. This radius may be expanded or contracted by the COR based on actual field measurements and is defined as the maximum distance between piles such that pile driving causes uplift of 0.04 ft or more in the affected pile.
9. By the end of each day of driving of piles, the Contractor shall determine the elevation of the reference points on each of the piles within the radius of heave. If heave of 0.04 ft or more has occurred on any pile within the radius of heave, the Contractor shall report those results to the COR so that a determination may be made on which piles shall be re-driven to their original elevation before the end of the shift. Piles may be re-driven deeper, if necessary, to the final driving criterion. After re-driving each pile, the Contractor shall re-establish the elevation of the reference point. Re-driving shall be repeated as often as necessary until the measured heave on any pile is less than 0.04 ft.
10. Piles in a group shall be driven commencing in the center of the group and working toward the edge. All piles in any group shall be driven before moving to other locations.

B. Obstructions:

1. Obstructions are defined as any man-made or man-placed objects below ground surface, which prevent installation of the new piles at the design locations and to the required depths. The piles will be driven from the existing grade prior to trench excavation or trench lateral support installation.
2. The Contractor shall make reference to the test pit, test boring logs, all available subsurface data and available plans showing the site conditions. The Contractor is advised that obstructions may be present.
3. If a pile is obstructed as defined herein, the Contractor shall immediately notify the COR who shall determine whether the location is to be excavated or if the pile(s) shall be moved or additional piles installed. If directed by the COR, the Contractor shall attempt to remove and redrive the undamaged, obstructed pile after the obstruction has been removed, at no additional cost to the Owner.
4. Holes abandoned because of obstructions shall be immediately backfilled with material approved by the COR.

C. Cutting Off Piles:

1. Pile tops shall be cut off square within one inch of the elevations shown on the Drawings. The pile cut offs shall be stockpiled in a designated area of the site and shall be removed from the site by the Contractor.

2. Pile build-ups will not be permitted. Piles driven below the design elevation shall be cutoff a minimum of one foot below the design bottom of the pile cap and abandoned at no cost

to the Owner. Additional piles required to compensate for an abandoned pile shall be driven as directed by the COR, at no additional cost to the Owner.

3.4 TOLERANCES AND CRITERIA FOR ACCEPTANCE

A. Location: Piles shall be driven as close as practicable to the plan location. A maximum permissible lateral deviation from the plan location (measured in any direction at cut off elevation) will be 3 inches for each pile supporting the proposed pile cap. A maximum deviation from design cut off elevation equal to one inch will be permitted.

B. Plumbness: The pile plumbness, as measured on the projection of the pile above ground, shall not deviate by greater than ten percent from the vertical alignment. Pulling piles into alignment or position will not be permitted.

C. Piles that are damaged below cut off elevation during driving will be rejected. If, upon comparing pile performance during driving with that of other driven piles and based on the COR's knowledge of subsurface conditions, the COR determines that a pile has been unacceptably damaged, the COR may reject the pile.

D. Piles indicating sudden or peculiar decrease in penetration resistance during driving will be assumed to be broken and will be rejected unless the COR's review of available data indicates that sudden decrease in driving resistance is due to natural subsurface conditions and continued acceptable driving behavior is observed.

E. Piles that are rejected because of damage, mislocation or misalignment, or failure to meet the driving criteria due to causes other than obstructions as defined herein, shall be cut off a minimum of 1 foot below the design bottom of the pile cap and abandoned, and additional piles shall be driven as directed by the COR at no additional cost to the Owner.

F. When otherwise acceptable installed piles exceed the specified tolerances, the Contractor shall drive an additional pile or piles as directed by the COR at no additional cost to the Owner. The COR will determine the locations of additional piles.

G. The installation of replacement piles and other corrective measures shall in all cases be in accordance with designs provided by the COR.

H. Any increased costs for redesign and for construction caused by rejected piles or piles exceeding tolerances shall be the responsibility of the Contractor.

3.5 PILE LOAD TESTING

NOT USED

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Piles will be measured for payment on a per pile unit price based on locations required on the Contract Drawings.

B. Standby time, authorized in advance by the COR, due to obstruction removal will be paid at the hourly rate quoted in the Contract.

C. Should an alternate to the specified pile be proposed by the Contractor and Pile Load Test determined to be required by the COR, the Load Test will be measured by successfully completed test in accordance with ASTM Standards and the Code.

4.2 BASIS OF PAYMENT

A. Work included under this contract shall include the total price for installation of the required number of 15-kip design capacity piles indicated on the contract drawings. The amount of such work shall include furnishing and driving the piles, cutting off new piles to specified grades, stockpiling cutoffs at the site, and mobilization and demobilization for pile driving which shall include job set up, moving equipment including pile driving rig on and off the project, establishing and dismantling the Contractor's field administration forces and equipment, and all other work incidental thereto.

B. Final payment shall be based upon the as designed number of piles. If additional piles are required based on as-driven capacity, these additional piles shall be the responsibility of the Contractor and installed at no additional cost to the Owner.

C. Except for piles damaged or rejected due to obstructions, piles rejected for non-compliance with these Specifications for any reason will not be paid for.

D. Additional piles required due to rejected or damaged piles by man-made or man-placed obstructions, in the judgment of the COR, will be installed at no additional cost to the Owner.

E. Whenever, in the judgment of the COR, misalignment or rejection of a pile or piles, caused by the Contractor's violation of the Specifications or his other error, necessitates structural redesign, the cost of such redesign shall be deducted from sums otherwise due to the Contractor under the Contract. If a redesigned saddle (pile cap) requires greater quantities of concrete and reinforcing steel, as compared with the quantities required for the saddle (pile cap) as originally designed, the additional cost for concrete, reinforcing steel and form work shall also be deducted from the contract price.

F. No separate payment will be made for survey control, saddle, pile redrives, pile splices, followers, cut offs, tension dowels, and pile build ups.

G. Unit pricing:

Item	Description	Quantity	Unit Price
316219-1	Furnish and install 15-kip design capacity timber piles		$_____/Ea
316219-2	Add/Deduct Piles		$_____/Ea
316219-3	Standby Time		$_____/Hr
316219-4	Pile Load Test		$_____/Ea

END OF SECTION

SECTION 32 05 13 - SOILS FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil materials.
2. Topsoil materials.

B. Related Sections:

1. Section 310513 - Soils for Earthwork.
2. Section 312213 - Rough Grading.
3. Section 312317 - Trenching.
4. Section 312323 - Fill.
5. Section 320516 - Aggregates for Exterior Improvements.
6. Document 0206170-000: Design Level Geotechnical Investigation; bore hole locations and findings of subsurface materials.
7. .

1.2 REFERENCES

A. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials source.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Regional products.

1.5 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

B. Perform Work in accordance with Municipality of Stinson Beach Public Work's standard.

C. Maintain one copy on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

2.2 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing and Inspection Services Testing and analysis of soil material.

B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698 and ASTM D1557.

C. Testing and Analysis of Topsoil Material: Analyze to determine percentage of nitrogen, phosphorus, potash, soluble salt, organic matter, and pH.

D. When tests indicate materials do not meet specified requirements, change material and retest.

E. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations indicated.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil 3 feet high maximum.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 32 05 13

SECTION 32 05 16 - AGGREGATES FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate materials.
2. Fine aggregate materials.

B. Related Sections:
1. Section 312213 - Rough Grading.
2. Section 312317 - Trenching.
3. Section 312323 - Fill.
4. Section 320513 - Soils for Exterior Improvements: Fill and grading materials.
5. Section 321123 - Aggregate Base Courses.
6. Section 331116 - Site Water Utility Distribution Piping.
7. Section 333100 - Sanitary Utility Sewerage Piping.
8.
9. Document 0206170-000: Design Level Geotechnical Investigation; bore hole locations and findings of subsurface materials.

1.2 REFERENCES

A. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction
3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
5. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit, in air-tight containers, 10 lb sample of each type of Type fill to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.
b. Regional products.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with Municipality of Stinson Beach Public Work's standard.

C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content .

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

2.2 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing and inspection services.

B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698 and ASTM D1557.

C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698 and ASTM D1557.

D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate aggregate materials from on-site locations as specified in Section 312213.

B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations indicated by COR.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 32 05 16

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate subbase.
2. Aggregate base course.

B. Related Sections:

1. Section 312213 - Rough Grading: Preparation of site for base course.
2. Section 312317 - Trenching: Compacted fill under base course.
3. Section 312323 - Fill: Compacted fill under base course.
4. Section 320516 - Aggregates for Exterior Improvements.
5. Section 321216 - Asphalt Paving: Finish asphalt courses.
6. Section 321313 - Concrete Paving: Finish concrete surface course.
7. Section 330513 - Manholes and Structures: Manholes including frames.

1.2 REFERENCES

A. ASTM International:

1. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
3. ASTM D2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit data for geotextile fabric and herbicide.

C. Samples: Submit, in air-tight containers, 10 lb sample of each type of aggregate fill to testing laboratory.

D. Materials Source: Submit name of aggregate materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

a. Certify source and origin for salvaged and reused products.
b. Certify recycled material content for recycled content products.
c. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Salvaged, refurbished, and reused products.
b. Products with recycled material content.
c. Regional products.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work according to Municipality of Stinson Beach Public Works standards.

C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted substrate is dry and ready to support paving and imposed loads.

1. Proof roll substrate with minimum two perpendicular passes to identify soft spots.
2. Remove soft substrate and replace with compacted fill as specified in Section 312323.

C. Verify substrate has been inspected, gradients and elevations are correct.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Install geotextile fabric over subgrade according to manufacturer's instructions.

1. Lap ends and edges minimum 6 inches.
2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

B. Place aggregate equal thickness layers to total compacted thickness indicated on Drawings.

1. Maximum Layer Compacted Thickness: 6 inches.
2. Minimum Layer Compacted Thickness: 3 inches.

C. Roller compact aggregate to 95 percent maximum density.

D. Level and contour surfaces to elevations, profiles, and gradients indicated.

E. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.

F. Maintain optimum moisture content of fill materials to attain specified compaction density.

G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Variation From Flat Surface: 1/2 inch measured with 10 foot straight edge.

C. Maximum Variation From Thickness: 1/4 inch.

D. Maximum Variation From Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Compaction testing will be performed according to ASTM D2922.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Tests: One test for every 1000 square yards of each layer compacted aggregate.

3.6 COMPACTION

A. Compact materials to 98 percent of maximum density as determined from test strip, according to ASTM D2940.

3.7 SCHEDULES

A. Asphalt Paving Base Course: 12 inches thick placed in three equal layers.

B. Concrete Paving Base Course: 6 inches thick placed in single layer.

END OF SECTION 32 11 23

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.
6. Surface slurry.

B. Related Requirement:
1. Section 312213 - Rough Grading: Preparation of site for paving.
2. Section 312323 - Fill: Compacted subbase for paving.
3. Section 320516 - Aggregates for Exterior Improvements: Product requirements for aggregate for placement by this section.
4. Section 321123 - Aggregate Base Courses: Compacted subbase for paving.
5. Section 330513 - Manholes and Structures: Manholes, drains and cleanouts including frames.

C. Aggregate Subbase:

1. Basis of Measurement: By cubic yard
2. Basis of Payment: Includes supplying and stockpiling aggregate, scarifying substrate surface, placing, and compacting subbase.

D. Asphalt Paving Base Course:

1. Basis of Measurement: By ton.
2. Basis of Payment: Includes priming surfaces, tack coating surfaces**,** furnishing, placing, compacting, and testing base course.

E. Asphalt Paving Binder Course:

1. Basis of Measurement: By ton.
2. Basis of Payment: Includes priming surfaces, tack coating surfaces, furnishing, placing, compacting, and testing binder course.

F. Asphalt Paving Wearing Course:

1. Basis of Measurement: By ton.
2. Basis of Payment: Includes priming surfaces, tack coating surfaces, furnishing, placing, compacting, and testing wearing course.

G. Tack Coat:

1. Basis of Measurement: By square yard.
2. Basis of Payment: Includes preparing surfaces and applying.

1.2 REFERENCE STANDARDS

A. Asphalt Institute:

1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

B. ASTM International:

1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.
4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.
7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit product information for asphalt and aggregate materials.
2. Submit mix design with laboratory test results supporting design.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Conform to California Department of Transportation standards.

1.5 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

C. Place asphalt mixture when temperature is not more than 15 degrees F less than initial mixing temperature.

PART 2 - PRODUCTS

2.1 ASPHALT PAVING

A. Asphalt Materials:
1. Asphalt Cement: ASTM D94 6
2. Primer: ASTM D2027
3. Tack Coat: ASTM D977

B. Aggregate Materials:

1. Coarse Aggregate: ASTM D692; crushed stone, gravel, or blast furnace slag.
2. Fine Aggregate: In accordance with California Department of Transportation standards.

2.2 ACCESSORIES

A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

B. Sealant: ASTM D6690**;** hot applied type.

2.3 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Submit proposed mix design for review prior to beginning of Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

1. Proof roll subbase in minimum two perpendicular passes to identify soft spots.
2. Remove soft subbase and replace with compacted fill as specified in Section 312323.

C. Verify gradients and elevations of base are correct.

D. Verify manhole and inlet frames are installed in correct position and elevation.

3.2 PREPARATION

A. Prepare subbase in accordance with California Department of Transportation standards.

3.3 DEMOLITION

A. Saw cut and notch existing paving.

B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.

C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.4 INSTALLATION

A. Subbase:

1. Prepare subbase in accordance with California Department of Transportation standards

B. Primer:

1. Apply primer in accordance with California Department of Transportation standards.

C. Tack Coat:

1. Apply tack coat in accordance with California Department of Transportation standards

D. Single Course Asphalt Paving:

1. Install Work in accordance with California Department of Transportation standards.
2. Place asphalt within 24 hours of applying primer or tack coat.
3. Place asphalt wearing course to thickness indicated on Drawings.
4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

E. Double Course Asphalt Paving:

1. Place asphalt binder course within 24 hours of applying primer or tack coat.
2. Place binder course to thickness indicated on Drawings.
3. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
4. Place wearing course to thickness indicated on Drawings.
5. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
6. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

F. Asphalt Paving Overlay

1. Apply tack coat to existing paving surface at rate recommended by geotextile fabric manufacturer.
2. Install geotextile fabric in accordance with manufacturer's instructions to permit asphalt saturation of fabric. Lap fabric edge and end joints 4 inches.
3. Place wearing course to thickness indicated on Drawings.
4. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

G. Surface Slurry

1. Install uniform thickness surface slurry over existing paving in accordance with ASTM D3910.
2. Allow slurry to cure.
3. Roll paving to achieve uniform surface.

3.5 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation from Indicated Elevation: Within 1/2 inch.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting, testing.

3.7 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from mechanical injury until surface temperature is less than 140 degrees F.

END OF SECTION 32 12 16

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete paving for:

      a. Concrete sidewalks.
      b. Concrete stair steps.
      c. Concrete curbs and gutters.
      d. Concrete median barriers.
      e. Concrete parking areas and roads.

B. Related Requirements:
   1. Section 312213 - Rough Grading: Preparation of site for paving.
   2. Section 312323 - Fill: Compacted subbase for paving.
   3. Section 321216 - Asphalt Paving.
   4. Section 330513 - Manholes and Structures.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

   1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

B. American Concrete Institute:

   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:

   1. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   3. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   6. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   7. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

8. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
9. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
10. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
11. ASTM C33 - Standard Specification for Concrete Aggregates.
12. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
13. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
14. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
15. ASTM C150 - Standard Specification for Portland Cement.
16. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
17. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
18. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
19. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
20. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
21. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
23. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
24. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
25. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
26. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
27. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
28. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
29. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
30. ASTM C1371[-2004a] - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
31. ASTM C1549[-2004] - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
32. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
33. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
34. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
35. ASTM E408[-1971(1996)e1] - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
36. ASTM E903[-1996] - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
37. ASTM E1918[-1997] - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

38. ASTM E1980[-2001] - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Section 013323 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit data on concrete materials, admixtures and curing compounds.

C. Design Data:

1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:

a. Hot and cold weather concrete work.

2. Identify mix ingredients and proportions, including admixtures.
3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

D. Source Quality Control Submittals: Indicate results of factory tests and inspections.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Sustainable Sites Certificates:

a. Certify paving materials solar reflectance index.

2. Materials Resources Certificates:

a. Certify recycled material content for recycled content products.
b. Certify source for regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Products with recycled material content.
b. Regional products.

1.5 QUALITY ASSURANCE

A. Perform Work according to ACI 301.

B. Obtain cementitious materials from same source throughout.

C. Perform Work according to California Department of Transportation standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.7 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 CONCRETE PAVING

A. Form Materials:

1. Form Materials: Conform to ACI 301.

B. Reinforcement:
1. Deformed Reinforcing: Steel: ASTM A615/A615M, plain billet bars.
2. Deformed Bar Mats: ASTM A184/A184M; fabricated from ASTM A615/A615M, steel bars.
3. Welded Deformed Wire Fabric: ASTM A497/A497M.

C. Concrete Materials:

1. Concrete Materials: according to Colorado Department of Transportation standards

2.2 MIXES

A. Concrete Mix - By Performance Criteria:

1. Mix and deliver concrete according to ASTM C94/C94M.

B. Concrete Mix - By Prescriptive Criteria:

1. Mix and deliver concrete according to ASTM C94/C94M, Option B.
2. Provide concrete to the following mix design:
    a. Compressive Strength: 4,500 psi at 28 days
    b. Maximum Water-Cement Ratio: 0.45 by weight
    c. Aggregate Size:
        1) Maximum: 1.5” inch
    d. Air Content: 5-8 percent, plus or minus 1.5 percent.
    e. Include admixture types and quantities indicated in concrete mix designs only if approved by Contracting Officer.
    f. Cold Weather:
        1) Use accelerating admixtures in cold weather.
        2) Use of admixtures will not relax cold-weather placement requirements.
3. Hot Weather: Use set-retarding admixtures.

2.3 SOURCE QUALITY CONTROL

A. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.

B. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify compacted subbase is dry.

1. Proof roll subbase in minimum two perpendicular passes to identify soft spots.
2. Remove soft subbase and replace with compacted fill as specified in Section 312323.

C. Verify gradients and elevations of base are correct.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Moisten substrate to minimize absorption of water from fresh concrete.

C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete paving.

D. Notify Contracting Officer minimum 24 hours prior to commencement of concreting operations.

3.3 INSTALLATION

A. Forms:

1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

B. Reinforcement:

1. Place reinforcing as indicated on Drawings.
2. Interrupt reinforcing at contraction and expansion joints.
3. Place dowels and reinforcing to achieve paving and curb alignment as detailed.
4. Repair damaged reinforcing to match shop finish.

C. Placing Concrete:

1. Place concrete using the slip form technique.
2. Ensure reinforcing, inserts, embedded parts and formed joints are not disturbed during concrete placement.
3. Place concrete continuously over the full width of the panel and between predetermined construction joints.

D. Joints

1. Place joints at 20 foot intervals. Align curb, gutter, and sidewalk joints.
2. Place joint filler between paving components and building or other appurtenances. Provide scored or sawn joints at regular intervals as indicated and between sidewalks and curbs, and between curbs and paving.
3. Provide keyed joints as indicated.

E. Finishing:

1. Paving: Light broom
2. Sidewalk Paving: Light broom
3. Median Barrier: Light broom
4. Curbs and Gutters: Light broom
5. Direction of Texturing: Transverse to paving direction.
6. Inclined Vehicular Ramps: Broomed perpendicular to slope.
7. Place curing compound on exposed concrete surfaces immediately after finishing.

F. Curing and Protection

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Variation of Surface Flatness: 1/2 inch in 10 ft.

C. Maximum Variation From True Position: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting, testing.

3.6 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

C. Do not permit pedestrian or vehicular traffic over paving for 7 days minimum after finishing.

END OF SECTION 32 13 13

SECTION 32 1723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Pavement-marking paint, solvent-borne.

2. Shop drawings to include plan locating pavement markings relative to other improvements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide pavement-marking products indicated in specifications or comparable products by one of the following and meeting the listed salient characteristics.

1. Vanguard ADA Systems Detectable Warning

2.2 SALIENT CHARACTERISTICS

A. Physical:
1. VOC: 25 g/l max,. ASTM D2205
2. Hardness: Shore Durometer, A-1, 80
3. Tensile Strength: 125 psi minimum at break, ASTM D638
4. Adhesion: minimum 200 PSI
5. Reflectivity: 200 millicandella minimum initial reading
6. Composition: Resin, reactive monomers, pigments, glass beads, fillers

7. Non-skid

B. Functional:
   1. Liner, detectable strips bonded to asphalt to indicate location of ABAAS ramp.
   2. Color: White, Yellow, Orange or as selected by Contracting Officer from manufacturer’s standard colors

C. Performance:
   1. Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction.
   2. Five-year warranty

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of .05 inch and .18 inch at warning system.

END OF SECTION 32 17 23

SECTION 32 91 13 - SOIL PREPARATION

PART 1 -

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work of this section includes preparation of soil for the purpose of soil conditioning for non-irrigated grass and shrubs.

1. Soil preparation consists of ripping, soil conditioning and fine grading the topsoil. Soil preparation as specified herein MUST proceed all seeding and planting.

1.3 SUBMITTALS

A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product.
1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Material Certificates: For each type of soil amendment before delivery to the site, according to the following:
   a. Manufacturer's qualified testing agency's certified analysis of standard products.

C. Samples: For each bulk supplied material, 1 gallon volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished. Provide an accurate representation of composition, color, and texture.

D. Quality Control Submittals
1. Certificates: State, Federal, and other inspection certificates shall accompany invoice for materials showing source or origin. Submit to the Contracting Officer prior to acceptance of material.
2. Material Analysis: Provide soil conditioner analysis performed no more than three months prior to delivery to site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Notify Contracting Officer of delivery schedule in advance so material can be inspected upon arrival at project site. Immediately remove unacceptable material from project site.

1.5 PROJECT/SITE CONDITIONS

A. General: Do not perform work when climate and existing site conditions will not provide satisfactory results.

B. Vehicular site access shall be limited to the area(s) indicated on the Drawings, or as defined by the Contracting Officer.

C. Damage to lawns, natural areas, pavements, irrigation systems, underground utilities, and other improvements shall be repaired by the Contractor at no additional cost to the NPS.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
   1. Laboratories: Subject to compliance with requirements:
   2. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: The General Contractor is to engage a qualified testing agency approved by the Contracting Officer to perform preconstruction soil analyses on existing topsoil.

1.8 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of General Contractor under the direction of the testing agency.
   1. Number and Location of Samples: Minimum of 8 representative soil samples from varied locations in the Project Limits.
   2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
   3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to NPS for its records.
   4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.9 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:
   1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
      a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
      b. Hydrometer Method: Report percentages of sand, silt, and clay.
   2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
   3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
   4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13, including the following:
1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm and sodium absorption ratio.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Soil Amendment Rates: State recommendations in weight per 1000 sq. ft.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Strip topsoil as required in Division 31 Section 31 2219 "Topsoil"

B. Soil Conditioner:
1. Composted material shall consist of aged organic matter, free of weed or other noxious plant seeds, lumps, stones, or other foreign contaminants harmful to plant life, and having the following characteristics based on a nutrient test performed no longer than 3 months prior to its incorporation into the project:
   a. Organic matter: 25% maximum.
   b. Salt content: 5.0 mmhos/cm maximum.
   c. pH: 7.5, maximum.
   d. Carbon to nitrogen ratio shall be less than 20:1.
2. Mountain peat, aspen humus, gypsum and sand will not be accepted.
3. Acceptable product: Class I compost, or approved equal.
4. If a site is unable to be tilled as determined by the Contracting Officer, then the following products shall be used as a soil conditioner:
   a. Organic slow release fertilizer (6-1-1), acceptable product: "Biosol" or approved equal.
   b. Granular Humic Acid soil conditioner, acceptable product: "Menefee Humate Soil Conditioner".
   c. Mycorrhizal Granular Inoculum. Acceptable product: "MycoApply Endo Granular.
   d. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

2.2 SOIL CONDITIONER APPLICATION RATES

A. Non-irrigated Planting Area:
1. Rates as directed per soils tests and agronomy report. Submit recommended amendment mixture and applications rates to Contracting Officer for approval prior to landscape operations.

2.3 HERBICIDE:

A. All herbicide applications require review and approval from Contracting Officer's Representative prior to use. Follow directions on label for application. Herbicides with acrolein will not be accepted.

1. Glyphosate-free, broad spectrum, non-staining, contact herbicide to treat annual weeds.
   a. d-Limoncene citrus oil base: 74-78% by weight
   b. Emulsifiers: 18 – 26" by weight
   c. pH: 4.8%
   d. Concentrate, spray-applied
   e. Acceptable product: Avenger Weed Killer as manufactured by Avenger Products.

2. Synthetic, broad spectrum, contact herbicide to treat annual weeds.
   a. Glyphosate, isopropylamine salt: 18%
   b. Diquat dibromide: .73%
   c: pH: 4.4 – 5.1%

d. Spray-applied
e. Acceptable product: Roundup Weed and Grass Killer Concentrate as manufactured by Monsanto Company.

PART 3 EXECUTION

3.1 EXAMINATION

A. General: Verify that existing site conditions are as specified and indicated on drawings before beginning work under this Section.
1. Grades: Inspect to verify rough grading is within +/- 0.1-foot of grades indicated and specified.
2. Damaged Earth: Inspect to verify that soil rendered unfit to support planting due to concrete, water, mortar, limewater or any other contaminant dumped on it has been removed and replaced with clean soil from a source approved by the Contracting Officer.

B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Contracting Officer.

C. Acceptance: Beginning of installation means acceptance of existing conditions by installer.

3.2 PREPARATION

A. Areas of Newly Placed Topsoil:
1. Protection:
a. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment prior to commencing work.
b. Contractor shall be responsible for proper repair to landscape, utilities, walls, pavements and other site improvements damaged by operations under this section.

B. Weed Control: Perform herbicide treatment over the entire area to be planted. Allow sufficient time to successfully complete the entire herbicide treatment process before proceeding with planting.
1. Herbicide treatment must be completed during the growing season.
2. Water surface 1/2" per week for two weeks prior to application if natural precipitation does not supply this amount to encourage weed seed germination.
3. Treat site with “Roundup” herbicide in accordance with manufacturer’s recommendations.
a. Two days after application water surface 1/2" per week if natural precipitation does not supply this amount to encourage weed seed germination.
b. Ten (10) days after the first “Roundup” application, review surface for evidence of plant growth.
c. Repeat steps 2, 3, 4, and 5, for a total of three (3) applications, until there is no evidence of plant growth after a 10-day period.
d. Obtain Contracting Officer approval of surface conditions fourteen (14) days after last herbicide application.
e. Herbicide treatments beyond the 3 applications shall be considered additional to the contract and will be performed at the direction of Contracting Officer after the NPS has approved the cost. Additional herbicide treatments required for imported topsoil shall be borne solely by the Contractor.
f. Remove plant debris from treated area.
g. Contact Contracting Officer 48 hours in advance to review the site after each herbicide treatment. Do not proceed with additional planting until the results are approved and accepted by the Contracting Officer.
5. Remove weeds, debris, clods and rocks larger than one 1-inch. Remove and dispose of accumulated materials at direction of Contracting Officer.

6. Erosion Control: Take measures and furnish equipment and labor necessary to control the flow, drainage and accumulation of water, and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site throughout duration of work. Insure that all excess water will run off the grades or will percolate within 12 hours.
7. Soil Testing: Soil amendments shall meet the minimum amounts as specified in Article 3.3, "Installation", below. Unless determined by the Contracting Officer the Contractor shall be responsible for performing horticultural soil tests on a minimum of 4 current soil samples for each source of topsoil to be used in the project. Soil test will be used to determine the type and amount of soil organic amendment and fertilizer to be applied prior to seeding, sodding and planting. Locations for testing shall be approved by the Contracting Officer.
8. Timing: Perform soil preparation just prior to planting operations and in accordance with final planting schedule. Coordinate with irrigation system installation to avoid damage.

C. Areas of Compacted Topsoil: Areas within the work limits or as defined on Drawings or by the Contracting Officer that have vegetation that is sparse, stunted, anemic, weedy or was used as a construction staging, parking area and/or subjected to heavy use will require ripping to prepare the soil for revegetation. Scarify compacted soil to a 6-inch depth minimum to loosen topsoil.

D. Areas of Disturbed Topsoil: Areas disturbed but not severely compacted as determined by the Parks Contracting Officer, shall be deep tine aerated or shattered to prepare the soil for revegetation.

E. Areas of Undisturbed Natural Topsoil: Undisturbed sites that are or were supporting healthy plant growth need only surface seedbed preparation prior to sowing seed.

3.3 INSTALLATION

A. Install topsoil as required in Division 31 Section 31 2219 "Topsoil"

B. Soil Preparation in Planting Areas:
1. Apply amendments as directed per soils tests and agronomy report.
2. After applying soil conditioner, thoroughly till area to depth of 6-inches minimum by plowing, rototilling, harrowing, or disking until soil is well pulverized and thoroughly mixed.

C. Fine Grading in all Landscape Areas:
1. Complete fine grading for all areas prior to seeding or planting. Allow for natural settlement.
2. For ground surface areas surrounding buildings to be landscaped, maintain required positive drainage away from buildings.
3. Establish finish grades to within plus or minus 0.10-foot of grades indicated, in order to prevent "bird-baths" or ponding.
4. Finish grade shall be below edge of pavement prior to planting.
   a. Sodded Areas: Allow 1-1/2-inches for grasses and shrubs.
5. Noxious weeds or parts thereof shall not be present in the surface grade prior to seeding.
6. Compaction of Surface Grade Prior to Landscape Installation: Firm, but not hard, 85% standard Proctor density within 2% optimum moisture.
7. Hand Raking:
   a. Planting Areas: Prior to acceptance of grades, hand rake to smooth, even surface, free of debris, clods, rocks and organic matter greater than 1-inch.
8. Restore planting areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

3.4 FIELD QUALITY CONTROL

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

B. Contractor is responsible for specified tests.

C. Perform the following tests:
   1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft.

D. Soil will be considered defective if it does not pass tests.

E. Prepare test reports.

F. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

G. Inspection: Provide notice to the Parks Contracting Officer requesting inspection at least 7 days prior to anticipated date of completion.

H. Deficiencies: The Contracting Officer will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Contracting Officer for final inspection.

3.5 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove debris and excess materials from site. Clean out drainage inlet structures. Clean paved and finished surfaces soiled as a result of work under this Section, in accordance with the General Specifications or as directed by the Contracting Officer.

3.6 PROTECTION

A. Provide and install barriers as required and as directed by Contracting Officer to protect completed areas against damage from pedestrian and vehicular traffic until acceptance by NPS.

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Vehicle traffic.
   4. Foot traffic.
   5. Erection of sheds or structures.
   6. Impoundment of water.
   7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Contracting Officer and replace contaminated planting soil with new planting soil.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

C. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

D. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples of each type of mulch.

1.5 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Contracting Officer for maintenance of plants during a calendar year.

1.7 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

1. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver bare-root stock plants within 24 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.

B. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

C. Handle planting stock by root ball.

D. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.

E. Deliver plants after preparations for planting have been completed and install immediately. Do not deliver more plants than be installed in a shift. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Contracting Officer.
b. Structural failures including plantings falling or blowing over.

2. Warranty Periods: From date of Substantial Completion.

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

2.2 FERTILIZERS

A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.3 MULCHES

Weed-free, organic mulch to protect new plantings, reduce soil erosion, regulate soil temperature, and retain moisture.

1. Feedstock: rice straw, agricultural or food residuals, yard trimmings.
2. Free of inert contaminants, substances toxic to planting, biosolids or manure.
3. Organic Matter: 15 to 35% percent of dry weight
4. pH: 5.5 to 8
5. Moisture content: 10 to 35%
6. Soluble-salt content of 2 to 5 dS.m
7. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum
8. Color: Natural

2.4 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: Blend planting soil in place.

C. Before planting, obtain CO's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines indicated on Drawings in even rows with triangular spacing.

B. Use backfill for planting soil.

C. Dig holes large enough to allow spreading of roots.

D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.3 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

D. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Contracting Officer's operations and others in proximity to the Work. Notify Contracting Officer before each application is performed.

E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.4 MAINTENANCE SERVICE

A. Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
   1. Maintenance Period for Ground Cover and Other Plants: 12 months from date of substantial completion.

END OF SECTION 329300

SECTION 33 01 10.58 - DISINFECTION OF WATER UTILITY PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Disinfection of potable water distribution and transmission system.
2. Testing and reporting of results.

B. Related Requirements:

1. Section 224000 - Plumbing Fixtures: Disinfection of building domestic water piping systems.
2. Section 331416 - Site Water Utility Distribution Piping: Product and execution requirements for installation and testing of site domestic water distribution piping.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA B300 - Hypochlorites.
2. AWWA B302 - Ammonium Sulfate.
3. AWWA B303 - Sodium Chlorite.
4. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Disinfection Procedure:

1. Submit description of procedure, including type of disinfectant and calculations indicating quantities of disinfectants required to produce specified chlorine concentration.

C. Product Data: Submit manufacturer information for proposed chemicals and treatment doses.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Certify that final water complies with disinfectant quality standards of local municipality.

F. Test and Evaluation Reports: Indicate testing results comparative to specified requirements.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Disinfection Report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

1.5 QUALITY ASSURANCE

A. Perform Work according to local jurisdictional standards.

B. Maintain one copy of each standard affecting Work of this Section on Site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals:

1. Hypochlorite: Comply with AWWA B300.
2. Ammonium Sulfate: Comply with AWWA B302.
3. Sodium Chlorite: Comply with AWWA B303.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that piping system has been cleaned, inspected, and pressure tested.

C. Verify that access fittings have been installed under Section 331416 - Site Water Utility Distribution Piping.

D. Perform scheduling and disinfecting activity with startup, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Provide required equipment to perform Work of this Section.

B. Introduce treatment into piping system.

C. Maintain disinfectant in system for 24 hours.

D. Flush, circulate, and clean until required disinfectant quality standard has been achieved using municipal domestic water.

E. Replace permanent system devices that were removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Disinfection, Flushing, and Sampling:

1. Disinfect pipeline installation according to AWWA C651.
2. Use of liquid chlorine is not permitted.
3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
4. Disposal:

    a. Legally dispose of chlorinated water.
    b. If chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.

5. After final flushing and before pipeline is connected to existing system or placed in service, certify that disinfectant level meets quality standards of authority having jurisdiction.

END OF SECTION 33 01 10.58

SECTION 33 01 30.86 - MANHOLE RIM ADJUSTMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Raising manhole frames and covers.
2. Replacing manhole frames and covers.

B. Related Requirements:
1. Section 321216 - Asphalt Paving: Restoration of bituminous paving areas.
2. Section 329119 - Landscape Grading: Restoration of grassed areas.
3. Section 333111 - Sanitary Sewerage Piping: Execution requirements for sewerage piping as required by this Section.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
3. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
4. ASTM C877 - Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
5. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
6. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
7. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.3 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.4 SCHEDULING

A. Section 013216 - Construction Progress Schedule: Requirements for scheduling.

B. Submit schedule for manhole grade adjustments.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for manhole covers and riser rings construction, features, configuration and dimensions.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

F. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.6 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate:

1. Certify that products meet or exceed specified sustainable design requirements.
2. Materials Resources Certificates:

    a. Certify recycled material content for recycled content products.
    b. Certify source for regional materials and distance from Project Site.

C. Product Cost Data:

1. Submit cost of products to verify compliance with Project sustainable design requirements.
2. Exclude cost of labor and equipment to install products.
3. Provide cost data for following products:

    a. Products with recycled material content.
    b. Regional products.

1.7 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual grade-adjusted elevation of manholes.

1.8 QUALITY ASSURANCE

A. Perform Work according to local municipality standards.

B. Maintain one copy of each standard affecting Work of this Section on Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANHOLE FRAMES AND COVERS

A. Description:

1. Material: Cast iron.
2. Comply with ASTM A48/A48M, Class 30B.
3. Surface: Machined flat bearing.
4. Lid: Removable and lockable.
5. Cover Design: Waterproof.

6. Live Load Rating: 185 psf.
7. Furnish sealing gasket.
8. Cover: Molded with identifying name and logo.

2.2 RISER RINGS

A. Riser Rings:

1. Thickness of 4 Inches to 6 Inches:

a. Material: Precast concrete.
b. Comply with ASTM C478.

2. Thickness of Less than 4 Inches:

a. Material: Cast iron.
b.

3. Rubber Seal Wraps:

a. Wraps and Band Widths: Comply with ASTM C877, Type III.
b. Cone/Riser Ring Joint: Minimum 3-inch overlap.
c. Frame/Riser Ring Joint: 2-inch overlap.
d. Additional Bands: Overlap upper band by 2 inches.

B. Accessories:

1. Joint Sealant: Comply with ASTM C990.
2. Bolts: Stainless steel; ASTM F593.

2.3 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2.4 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

C. Owner Inspection:

1. Make completed manhole frames and covers available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

D. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

E. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify and locate manholes requiring grade adjustment.

3.2 INSTALLATION

A. Raising Manhole Frames and Covers:

1. Locate and raise manholes to grade as indicated on Drawings.
2. Use flat or tapered rubber manhole rings to achieve indicated elevation for frame and cover.
3. Do not adjust elevation greater than 6 inches with rubber manhole rings.
4. Use sealant to seal joints between manhole top, rubber rings, and frame.
5. Reinstall removed manhole frame and cover.

B. Replacing Manhole Frames and Covers:

1. Locate manholes for replacement of frames and covers as indicated on Drawings.
2. Remove existing manhole frames and covers to enable reuse.
3. Deliver removed manhole frames and covers to Owner as maintenance materials as specified in Section 017000 - Execution and Closeout Requirements.
4. Install new frames and covers for manholes as indicated on Drawings.
5. Adjust new frames and covers to match finished grade as indicated on Drawings.
6. Seal joints between manholes and manhole frames.

C. Paving Restoration:

1. Restore bituminous paving areas as specified in Section 321216 - Asphalt Paving.

END OF SECTION 33 01 30.86

SECTION 33 05 05.31 - HYDROSTATIC TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hydrostatic testing of pressure piping.

B. Related Requirements:
   1. Section 331416 - Site Water Utility Distribution Piping: Pipe materials and accessories normally encountered with pressurized water distribution systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:

   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   4. Provisions for disposal of flushing and test water.
   5. Certification of test gage calibration.

C. Test and Evaluation Reports: Indicate results of piping tests.

D. Qualifications Statement:

   1. Submit qualifications for applicator.

1.4 QUALITY ASSURANCE

A. Perform Work according to local municipality standards.

B. Maintain one copy of each standard affecting Work of this Section on Site.

1.5 QUALIFICATIONS

A. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 HYDROSTATIC TESTING

A. Equipment:

1. Pressure pump.
2. Pressure hose.
3. Water meter.
4. Test connections.
5. Pressure relief valve.
6. Pressure Gage: Calibrated to 0.1 psi.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that piping is ready for testing.

C. Verify that trenches are backfilled.

D. Verify that pressure piping thrust restraints have been installed.

3.2 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing of Pressure Piping:

1. Test system according to AWWA C600 and following:

a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
b. Conduct hydrostatic testing for at least two hours.
c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
d. Install corporation cocks at high points.

e. Close air vents and corporation cocks after air is expelled.
f. Raise pressure to specified test pressure.
g. Observe joints, fittings, and valves undergoing testing.
h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage.
i. Retest.
j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
k. Maintain pressure within plus or minus 5.0 psi of test pressure.
l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
m. Compute maximum allowable leakage using following formula:

1) L = [SD x sqrt(P)]/C.
2) L = testing allowance, gph.
3) S = length of pipe tested, feet.
4) D = nominal diameter of pipe, inches.
5) P = average test pressure during hydrostatic testing, psig.
6) C = 148,000.
7) If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

2. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
3. Correct visible leaks regardless of quantity of leakage.

END OF SECTION 33 05 05.31

SECTION 33 05 05.33 - INFILTRATION AND EXFILTRATION TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing of Gravity Sewer Piping:

a. Exfiltration testing.
b. Infiltration testing.

2. Testing of Manholes: Exfiltration testing.

B. Related Requirements:
1. Section 330130.86 - Manhole Rim Adjustment: Raising or replacing of designated manhole rims.
2. Section 333111 - Public Sanitary Sewerage Gravity Piping: Pipe materials, manholes, and accessories normally encountered with gravity sewerage piping.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:

1. Testing procedures.
2. List of test equipment.
3. Testing sequence schedule.
4. Provisions for disposal of flushing and test water.
5. Certification of test gage calibration.

C. Test and Evaluation Reports: Indicate results of manhole and piping tests.

D. Qualifications Statement:

1. Submit qualifications for applicator.

1.3 QUALITY ASSURANCE

A. Perform Work according to local municipality standards.

1.4 QUALIFICATIONS

A. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 EXFILTRATION TESTING

A. Equipment:

1. Plugs.
2. Pump.
3. Measuring device.

2.2 INFILTRATION TESTING

A. Equipment: Weirs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that manholes and piping are ready for testing.

C. Verify that trenches are backfilled.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for preparation.

B. Lamping:

1. Lamp gravity piping after flushing and cleaning.
2. Perform lamping operation by shining light at one end of each pipe section between manholes.
3. Observe light at other end.
4. Pipe not installed with uniform line and grade will be rejected.
5. Remove and reinstall rejected pipe sections.
6. Clean and lamp until pipe section is installed to uniform line and grade.

C. Plugs:

1. Plug outlets, wye branches, and laterals.
2. Brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Infiltration Testing:

1. Maximum Allowable Infiltration: 100 gal./in. of pipe diameter for each mile per day for reach of piping undergoing testing.
2. Include allowances for leakage from manholes.
3. Perform testing with minimum positive head of 2 feet.

C. Manhole Testing:

1. Repair both outside and inside of joint to ensure permanent seal.
2. Test manholes with manhole frame set in place.
3. Plug pipes in manhole.
4. Remove water from manhole.
5. Observe plugs over period of not less than two hours to ensure that there is no leakage into manhole.
6. Determine ground water level outside manhole.
7. Fill manhole with water within 4 inches of top of cover frame.
8. Prior to testing, allow manhole to soak from minimum of four hours to maximum of 72 hours.
9. After soak period, adjust water level inside manhole to within 4 inches of top of cover frame.
10. Measure water level from top of manhole frame.
11. At end of four-hour testing period, again measure water level from top of manhole frame; compute drop in water level during testing period.
12. Manhole exfiltration test is considered satisfactory when drop in water level is less than following:

    a. Manhole Depth of 4 Feet:

        1) Diameter of 4 feet: 0.11 inch.
        2) Diameter of 5 feet: 0.14 inch.
        3) Diameter of 6 feet: 0.17 inch.

    b. Manhole Depth of 6 Feet:

        1) Diameter of 4 feet: 0.17 inch.
        2) Diameter of 5 feet: 0.21 inch.
        3) Diameter of 6 feet: 0.26 inch.

    c. Manhole Depth of 8 Feet:

        1) Diameter of 4 feet: 0.23 inch.

2) Diameter of 5 feet: 0.29 inch.
3) Diameter of 6 feet: 0.35 inch.

d. Manhole Depth of 10 Feet:

1) Diameter of 4 feet: 0.28 inch.
2) Diameter of 5 feet: 0.35 inch.
3) Diameter of 6 feet: 0.42 inch.

13. If unsatisfactory testing results are achieved, repair manhole and retest until result meets criteria.
14. Repair visible leaks regardless of quantity of leakage.

END OF SECTION 33 05 05.33

SECTION 33 05 09.33 - THRUST RESTRAINT FOR UTILITY PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tied joint restraint system.

B. Related Requirements:

1. Section 312316.13 - Trenching: Trenching and backfilling requirements for Site utilities.
2. Section 331416 - Site Water Utility Distribution Piping: Requirements for piping Work as required by this Section.
3. Section 333111 - Public Sanitary Sewerage Gravity Piping: Requirements for piping Work as required by this Section.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. ASME International:

1. ASME B1.1 - Unified Inch Screw Threads, UN and UNR Thread Form.

C. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
5. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
6. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
7. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance.
8. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
9. ASTM F436 - Standard Specification for Hardened Steel Washers.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with installation of fittings and joints that require restraint.

1.4 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer catalog information for restrained joint details and installation instructions.

C. Shop Drawings:

1. Indicate restrained joint details and materials being used.
2. Submit layout drawings showing piece numbers and locations.
3. Indicate restrained joint locations.

D. Samples: Submit two samples of joint restraint parts.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Delegated Design Submittals:

1. Submit signed and sealed Shop Drawings with design calculations and assumptions for restrained lengths.
2. Submit joint restraint details.
3. Use joint restraint devices specifically designed for applications described in manufacturer information.

G. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

H. Qualifications Statement:

1. Submit qualifications for manufacturer, fabricator, and licensed professional.

1.6 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate:

1. Certify that products meet or exceed specified sustainable design requirements.
2. Materials Resources Certificates:

a. Certify source and origin for salvaged and reused products.
b. Certify recycled material content for recycled content products.
c. Certify source for regional materials and distance from Project Site.

C. Product Cost Data:

1. Submit cost of products to verify compliance with Project sustainable design requirements.
2. Exclude cost of labor and equipment to install products.
3. Provide cost data for following products:

a. Salvaged, refurbished, and reused products.
b. Products with recycled material content.
c. Regional products.

1.7 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of joint restraints.

1.8 QUALITY ASSURANCE

A. Perform Work according to local municipality standards.

B. Maintain one copy of each standard affecting Work of this Section on Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' documented experience and approved by manufacturer.

C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of California.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide pressure pipeline with restrained joints at each bend, tee, and change in direction.

2.2 TIED JOINT RESTRAINT SYSTEMS

A. Tie Bolts:

1. Mechanical Joints on 2- and 3-Inch Pipe:

a. Size: 5/8 inch.
b. Comply with ASTM A588/A588M, Grade B.
c. Comply with ASTM A325, Type 3, except increase tensile strength of full-body threaded section to 40,000 lb. minimum for 5/8 inch and 60,000 lb. minimum for 3/4 inch by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

2. Mechanical and Flanged Joints on 4- to 12-Inch Pipe:

a. Size: 3/4 inch.
b. Comply with ASTM A588/A588M, Grade B.
c. Comply with ASTM A325, Type 3, except increase tensile strength of full-body threaded section to 40,000 lb. minimum for 5/8 inch and 60,000 lb. minimum for 3/4 inch by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

3. Mechanical Joints on 14- to 24-Inch Pipe:

a. Size: 3/4 inch.
b. Comply with ASTM A588/A588M, Grade B and ASTM A325, Type 3.

4. Mechanical and Flanged Joints on 30-Inch and Larger Pipe:

    a. Size: 1 inch.
    b. Comply with ASTM A588/A588M, Grade B.
    c. Comply with ASTM A325, Type 3, except increase tensile strength of full-body threaded section to 100,000 lb. minimum by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

B. Tie Nut:

1. Description: Hex nut for each tie bolt and tie rods.
2. Comply with ASTM A563, Grade C3.
3. Finish: Zinc plated or galvanized.

C. Tiepin:

1. Bends and Hydrants: 3/4-inch round bar stock.
2. Size and Shape: 6-inch hairpin.
3. Comply with ASME B1.1 and ASTM A588/A588M.
4. Finish: Plain or zinc plated.

D. Tie Coupling:

1. Description: Extension of continuous-threaded rods.
2. Provide with center stop to aid installation.
3. Comply with ASTM A588/A588M.
4. Finish: Plain or zinc plated.

E. Tie Clamp:

1. Description: Retainer clamp for ductile iron, asbestos-cement, and PVC push-on pipe.
2. Location: In front of bell.
3. Comply with ASTM A36/A36M, ASTM A307, Grade A, and ASTM A563, Grade A.
4. Finish: Plain or zinc plated.

F. Tie Rod:

1. Description: Continuous-threaded rod for cutting to desired lengths.
2. Comply with ASTM A588/A588M, Grade B, ASTM A325, Type 3, and ASME B1.1.
3. Finish: Plain or zinc plated.

G. Tie Bar:

1. Description: Steel bar used to restrain push-in plugs.
2. Comply with ASTM A36/A36M.
3. Finish: Plain or zinc plated.

H. Tie Washer:

1. Description: Round flat washers.
2. ASTM A588/A588M, ASTM F436, Type 1.

3. Finish: Plain or zinc plated.

2.3 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

2.4 MATERIALS

A. Steel:

1. High-Strength Low-Alloy Steel: Comply with ASTM A588/A588M, heat treated.
2. High-Strength Low-Alloy Steel: Comply with ASTM A588/A588M.
3. Carbon Steel: Comply with ASTM A36/A36M.

2.5 FINISHES

A. Zinc Plating:

1. Factory applied.
2. Comply with ASTM B633.

B. Galvanizing:

1. Factory applied.
2. Comply with ASTM A153/A153M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that pipe and fittings are ready to receive Work.

C. Field measure and verify conditions for installation of Work.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Clean surfaces of pipe and fittings that are to receive tied joint restraint systems.

3.3 INSTALLATION

A. According to AWWA C600.

B. Install joint restraint system such that joints are mechanically locked together to prevent joint separation.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Torque 5/8-inch nuts on mating threaded fasteners from 45 to 60 ft.-lbf.

C. Torque 3/4-inch nuts on mating threaded fasteners from 75 to 90 ft.-lbf.

D. Torque 1-inch nuts from 100 to 120 ft.-lbf.

END OF SECTION 33 05 09.33

SECTION 33 05 53 - IDENTIFICATION FOR UTILITIES PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.

B. Related Requirements:
1. Section 331416 - Site Water Utility Distribution Piping: Materials and methods for piping, valves, and appurtenances.
2. Section 333111 - Sanitary Utility Sewerage Piping: Materials and methods for piping, valves, and appurtenances.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color-coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Samples: Submit two pipe markers, for each size used on Project.

E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Qualifications Statements:

1. Submit qualifications for manufacturer.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify that the following products meet or exceed specified sustainable design requirements.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Salvaged, refurbished, and reused products.
b. Products with recycled material content.
c. Regional products.

1.6 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials: Furnish two containers of spray-on adhesive.

C. Tools: Furnish special crimpers and other devices required for Government to re-install tags.

1.8 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Perform Work according to local municipality standards.

C. Maintain one copy of each standard affecting the Work of this Section on-Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved black letters on light, contrasting background color.

2.2 TAGS

A. Plastic Tags

1. Description:
   a. Laminated three-layer plastic with engraved black letters on light, contrasting background color.
   b. Minimum Tag Size and Configuration: 1-1/2 inch; square.

B. Metal Tags
1. Description:
   a. Brass or Stainless-steel construction; stamped letters.
   b. Minimum Tag Size and Configuration: 1-1/2 inch; square with finished edges.

C. Information Tags
1. Description:
   a. Clear plastic with printed CAUTION and message.
   b. Minimum Tag Size: 3-1/4 by 5-5/8 inch.
   c. Furnish grommet and self-locking nylon ties.

2. Tag Chart: Typewritten, letter-size list of applied tags and location, plastic laminated.

2.3 STENCILS

A. Description:

1. Clean-cut symbols.
2. Letters:

   a. Up to 2-inch Outside Diameter of Insulation or Pipe: 1/2-inch-high letters.
   b. 2-1/2- to 6-inch Outside Diameter of Insulation or Pipe: 1-inch -high letters.
   c. Over 6-inch Outside Diameter of Insulation or Pipe: 1-3/4-inch -high letters.

B. Stencil Paint: As specified in Section 099000 - Painting and Coating; semigloss enamel.

C. Color-Coding and Lettering Size: Conform to ASME A13.1.

2.4 PIPE MARKERS

A. Color-Coding and Lettering Size: Conform to ASME A13.1.

B. Plastic Pipe Markers
   1. Description:

      a. Factory-fabricated, flexible, semi-rigid plastic.
      b. Preformed to fit around pipe or pipe covering.
      c. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers
   1. Description: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

D. Plastic, Underground Pipe Markers
   1. Description:

      a. Brightly colored, continuously printed, plastic ribbon tape.
      b. Minimum 6 inches wide by 4 mils thick.
      c. Manufactured for direct burial service.

2.5 CEILING TACKS

A. Description:

   1. Steel construction.
   2. Head: 3/4-inch diameter; color-coded.

B. Color-Coding and Lettering Size: Conform to ASME A13.1.

2.6 LABELS

A. Description:

   1. Aluminum construction.
   2. Minimum Size: 1.9 by 0.75 inch.
   3. Adhesive backed, with printed identification.

2.7 LOCKOUT DEVICES

A. Lockout Hasps
   1. Description:

      a. Anodized aluminum construction.
      b. Furnish hasp with erasable label surface.

c. Minimum Size: 7-1/4 by 3 inches.

B. Valve Lockout Devices
1. Description:

a. Nylon or construction.
b. Furnish device preventing access to valve operator and accepting lock shackle.

2.8 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.
2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Prepare surfaces as specified in Section 099000 - Painting and Coating for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting as specified in Section 099000 - Painting and Coating.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.

D. Labels:

1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
2. For unfinished covering, apply paint primer before applying labels.

E. Tags:

1. Install tags using corrosion-resistant chain.
2. Number tags consecutively by location.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify valves in main and branch piping with tags.

H. Piping:

1. Identify piping, concealed or exposed, with plastic pipe markers.
2. Use tags on piping 3/4-inch diameter and smaller.
3. Identify service, flow direction, and pressure.
4. Install in clear view and align with axis of piping.
5. 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.

I. Ceiling Tacks:

1. Provide ceiling tacks to locate valves above T-bar-type panel ceilings.
2. Locate in corner of ceiling panel closest to equipment.

END OF SECTION 33 05 53

SECTION 33 05 61 – CONCRETE MANHOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular precast concrete manholes and structures with tongue-and-groove joints and transition to cover frame, covers, anchorage, and accessories.
2. Masonry manhole and structure sections with masonry transition to cover frame, covers, anchorage, and accessories.
3. Cast-in-place concrete manholes and structures with transition to cover frame, covers, anchorage, and accessories.
4. Doghouse manhole connections to existing sanitary and storm sewer lines.
5. Bedding and cover materials.
6. Pile support systems.
7. Vertical adjustment of existing manholes and structures.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Erection and bracing of forms.
2. Section 032000 - Concrete Reinforcing: Reinforcing steel as required by this Section.
3. Section 033000 - Cast-in-Place Concrete: Concrete type for manhole and structure foundation slab construction.
4. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
5. Section 312316 - Excavation: Excavating for manholes, structures, and foundation slabs.
6. Section 312323 - Fill: Backfilling after manhole and structure installation.
7. Section 330130.86 - Manhole Rim Adjustment: Resetting existing castings and grates.
8.
9. Section 333111 - Public Sanitary Sewerage Gravity Piping: Piping connections to manholes.

1.2 DEFINITIONS

A. Bedding: Specialized material placed under manhole prior to installation and subsequent backfill operations.

1.3 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.

B. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
4. ASTM C55 - Standard Specification for Concrete Building Brick.
5. ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
6. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
8. ASTM C877 - Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
9. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
10. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
11. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
12. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
13. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for manhole covers, component construction, features, configuration, dimensions.

C. Shop Drawings:

1. Indicate structure locations and elevations.
2. Indicate sizes and elevations of piping, conduit, and penetrations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of manholes and connections, and record invert elevations.

1.6 QUALITY ASSURANCE

A. Perform Work according to Colorado Department of Transportation standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Handling: Comply with precast concrete manufacturer instructions and ASTM C913 for unloading and moving precast manholes and drainage structures.

D. Storage:

1. Store materials according to manufacturer instructions.
2. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
3. Repair property damaged from materials storage.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry Work.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five year manufacturer's warranty for concrete manholes.

PART 2 - PRODUCTS

2.1 CONCRETE AND MASONRY MANHOLES

A. Manhole Sections:

1. Materials:

a. Reinforced Precast Concrete: Comply with ASTM C478.
b. Gaskets: Comply with ASTM C923.

2. Joints:

a. Comply with ASTM C913.
b. Maximum Leakage: 0.025 gal. per hour per foot of joint at 3 feet of head.

2.2 FRAMES AND COVERS

A. Description:

1. Material:

a. Cast iron.
b. Comply with ASTM A48/A48M, Class 30B.

2. Lid:

a. Bearing Surface: Machined flat.
b. Configuration: Removable.

3. Cover Design: according to design drawings.
4. Furnish sealing gasket.

2.3 RISER RINGS

A. Riser Rings:

1. Thickness of 4 to 6 Inches:

a. Precast concrete.
b. Comply with ASTM C478.

2. Thickness Less Than 4 Inches:

    a. Cast iron.
    b. Comply with AASHTO M306.

3. Rubber Seal Wraps:

    a. Wraps and Band Widths: Comply with ASTM C877, Type III.
    b. Cone/Riser Ring Joint: Minimum 3-inch overlap.
    c. Frame/Riser Ring Joint: 2-inch overlap.
    d. Additional Bands: Overlap upper band by 2 inches.

2.4 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

C. Owner Inspection:

1. Make completed product available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

D. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

E. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that items provided by other Sections of Work are properly sized and located.

C. Verify that built-in items are in proper location and are ready for roughing into Work.

D. Verify that excavation base is ready to receive Work and excavations and that dimensions and elevations are as indicated on drawings.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.

C. Coordinate placement of inlet and outlet pipe or duct sleeves as required by other Sections.

D. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.

E. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.3 INSTALLATION

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.

B. Correct over-excavation.

C. Remove large stones or other hard matter impeding consistent backfilling or compaction.

D. Protect manhole from damage or displacement while backfilling operation is in progress.

E. Excavating:

1. As specified in Section 312316 - Excavation and in indicated locations and depths.
2. Provide clearance around sidewalls of manhole or structure for construction operations.
3. If ground water is encountered, prevent accumulation of water in excavations; place manhole or structure in dry trench.
4. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation as approved by Architect/Engineer.

F. Base and Alignment:

1. Place foundation slab and trowel top surface level.
2. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour.
3. Place manhole sections plumb and level, trim to correct elevations, and anchor to foundation slab.

G. Attachments:
1. Cut and fit for pipe, conduit and sleeves.
2. Set cover frames and covers level to correct elevations without tipping.

H. Precast Concrete Manholes:

1. Lift precast components at lifting points designated by manufacturer.
2. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
3. Assembly:

    a. Assemble multisection manholes and structures by lowering each section into excavation.
    b. Install rubber gasket joints between precast sections according to manufacturer recommendations.
    c. Lower, set level, and firmly position base section before placing additional sections.

4. Remove foreign materials from joint surfaces and verify that sealing materials are placed properly.
5. Maintain alignment between sections by using guide devices affixed to lower section.
6. Joint sealing materials may be installed on Site or at manufacturer's plant.
7. Verify that installed manholes and structures meet required alignment and grade.
8. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
9. Cut pipe flush with interior of structure.
10. Shape inverts through manhole and structures as indicated on Drawings.

I. Masonry Manholes:

1. Maintain masonry courses to uniform dimension.
2. Form vertical and horizontal joints of uniform thickness.
3. Lay masonry units in running bond.
4. Course one unit and one mortar joint to equal 8 inches.
5. Form flush mortar joints.
6. Lay masonry units in full bed of mortar with full head joints, uniformly jointed with other Work.
7. Install joint reinforcement 16 inches o.c.
8. Place joint reinforcement in first horizontal joints above base pad and below cover frame opening.

J. Cast-in-Place Concrete Manholes:

1. Bear firmly and fully on compacted crushed stone bedding
2. Erect and brace forms against movement as specified in Section 031000 - Concrete Forming and Accessories.
3. Install reinforcing steel as indicated on Drawings and as specified in Section 032000 - Concrete Reinforcing.
4. Place and cure concrete as specified in Section 033000 - Cast-in-Place Concrete.
5. Frames and Covers:

    a. Set frames using mortar and masonry.
    b. Install radially laid concrete brick with 1/4-inch-thick, vertical joints at inside perimeter.
    c. Lay concrete brick in full bed of mortar and completely fill joints.
    d. If more than one course of concrete brick is required, stagger vertical joints.

e. Set frame and cover 2 inches above finished grade for manholes and structures with covers located within unpaved areas, to allow area to be graded away from cover beginning 1 inch below top surface of frame.

K. Doghouse Manholes and Structures:

1. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.
2. Carefully excavate around existing sewer line to adequate depth for foundation slab installation.
3. Protect existing pipe from damage.
4. Cut out soft spots and replace with granular fill compacted to 95 percent maximum density.
5. Bear firmly and fully on compacted crushed stone bedding.
6. Install precast concrete manhole or structure around existing pipe according to applicable Paragraphs in this Section.
7. Grout pipe entrances as specified in Section 033000 - Cast-in-Place Concrete.

L. Sanitary Manhole Drop Connections:

1. Concrete Encasement: Minimum 2 feet outside of manhole.
2. Form channel from pipe drop to sweep into main channel at maximum angle of 30 degrees.

M. Castings:

1. Set frames using mortar and masonry.
2. Install radially laid concrete brick with 1/4-inch-thick, vertical joints at inside perimeter.
3. Lay concrete brick in full bed of mortar and completely fill joints.
4. If more than one course of concrete brick is required, stagger vertical joints.
5. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

3.5 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Vertical Adjustment of Existing Manholes and Structures:
1. If required, adjust top elevation of existing manholes and structures to finished grades as indicated on Drawings.
2. Frames, Grates, and Covers:

a. Remove frames, grates, and covers cleaned of mortar fragments.
b. Reset to required elevation according to requirements specified for installation of castings.

3. Reinforcing Bars:

    a. Remove concrete without damaging existing vertical reinforcing bars if removal of existing concrete wall is required.
    b. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement as indicated on Drawings.

4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete.

END OF SECTION 33 05 61

SECTION 33 05 63 - CONCRETE VAULTS AND CHAMBERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete vaults and chambers.
2. Drainage system junction boxes.
3. Drainage system sedimentation chambers.
4. Knock-out boxes.
5. End walls.
6. Pipe ends.
7. Frames and covers.
8. Access hatches.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Erection and bracing of forms.
2. Section 032000 - Concrete Reinforcing: Reinforcing steel as required by this Section.
3. Section 033000 - Cast-in-Place Concrete: Concrete type for concrete vault or chamber construction.
4. Section 312316 - Excavation: Excavating for vaults or chambers, and foundation slabs.
5. Section 312323 - Fill: Backfilling after vault or chamber installation.
6. Section 333111 - Public Sanitary Sewerage Gravity Piping: Piping connections to vaults or chambers.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.

B. American Welding Society:

1. AWS D1.1/D1.1M - Structural Welding Code - Steel.
2. AWS D1.4/D1.4M - Structural Welding Code - Reinforced Steel.

C. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A48 - Standard Specification for Gray Iron Castings.
3. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

5. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
6. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
7. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
8. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
9. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
10. ASTM C877 - Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
11. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
12. ASTM A996 - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
13. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
14. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
15. ASTM C33 - Standard Specification for Concrete Aggregates.
16. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
17. ASTM C138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
18. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
19. ASTM C150 - Standard Specification for Portland Cement.
20. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
21. ASTM C192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
22. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
23. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
24. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
25. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
26. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
27. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
28. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
29. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
30. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
31. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
32. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
33. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
34. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.

35. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
36. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
37. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
38. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
39. ASTM C1433 - Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers.
40. ASTM C1504 - Standard Specification for Manufacture of Precast Reinforced Concrete Three-Sided Structures for Culverts and Storm Drains.
41.

D. National Precast Concrete Association:

1. NPCA Plant Certification Program.
2. NPCA Quality Control Manual for Precast and Prestressed Concrete Plants.

E. The Society for Protective Coatings:

1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information regarding frames and covers, component construction, features, configuration, and dimensions.

C. Shop Drawings:

1. Indicate vault or chamber locations, elevations, sections, piping, sizes and elevations of penetrations.
2. Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings and for each type, size, and configuration.

D. Submit concrete mix design for each different mix.

E. Samples: Submit two precast concrete samples, 6 by 6 inches in size, illustrating finishes exposed to view.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

H. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for custom fabrications.

I. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

J. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

K. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

L. Qualifications Statements:

1. Submit qualifications for manufacturer, and installer.
2. Submit manufacturer's approval of installer.
3. Welders: Qualify procedures and personnel according to AWS D1.1/D1.1M.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate:

1. Certify that products meet or exceed specified sustainable design requirements.
2. Materials Resources Certificates:

a. Certify source and origin for salvaged and reused products.
b. Certify recycled material content for recycled content products.
c. Certify source for regional materials and distance from Project Site.
d. Certify that lumber is harvested from Forest Stewardship Council (FSC)-Certified well-managed forest.

C. Product Cost Data:

1. Submit cost of products to verify compliance with Project sustainable design requirements.
2. Exclude cost of labor and equipment to install products.
3. Provide cost data for following products:

a. Salvaged, refurbished, and reused products.
b. Products with recycled material content.
c. Regional products.
d. Certified wood products.

1.6 QUALITY ASSURANCE

A. Obtain precast concrete vaults and chambers from single source.

B. Perform structural design according to ACI 318.

C. Perform Work according to NPCA Quality Control Manual for Precast and Prestressed Concrete Plants.

D. Material and Fabrication:

1. Single-Cell Box Culverts: Comply with ASTM C1433.
2. Multiple-Cell Box Culverts: Comply with local municipality standards.
3. Three-Sided Structures: Comply with ASTM C1504.
4. Other Structures: Comply with ASTM C913.

E. Welding:

1. Structural Steel: Comply with AWS D1/1/D1.1M.
2. Reinforcing Steel: Comply with AWS D1.4/D1.4M.

F. Maintain one copy of each standard affecting Work of this Section on Site.

1.7 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 three years' documented experience and approved by manufacturer.

C. Welders: AWS qualified within previous 12 months for employed weld types.

D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of California.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Concrete Products: Do not deliver products until concrete has cured five days or has attained minimum 75 percent of specified 28-day compressive strength.

C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

D. Handling:

1. Comply with manufacturer instructions for unloading, storing, and moving vaults or chambers.
2. Lift vaults or chambers from designated lifting points.

E. Storage:

1. Store materials according to manufacturer instructions.
2. Store vaults and chambers to prevent damage to Owner's property or other public or private property.
3. Repair property damaged from materials storage.

F. Protection:

1. Protect materials in clean location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for concrete vaults, chambers, and appurtenances.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Minimum Loading: Comply with ASTM C857 and ASTM C890.

B. Roof Live Load, with Impact Loading:

1. Heavy Traffic:

a. Comply with ASTM C857; A-16.
b. Maximum Each Wheel: 16,000 lbf. (71.2 kN).

2. Medium Traffic:

a. Comply with ASTM C857; A-12.
b. Maximum Each Wheel: 12,000 lbf..

3. Light Traffic:

a. Comply with ASTM C857; A-8.
b. Maximum Each Wheel: 8,000 lbf..

4. Walkway Traffic:

a. Comply with ASTM C857; A-0.3.
b. Maximum Loading: 300 psf.

2.2 PRECAST CONCRETE VAULTS AND CHAMBERS

A. Material of Construction: Reinforced precast concrete.

B. Foundation Slab:

1. Cast-in-place concrete of type as specified in Section 033000 - Cast-in-Place Concrete.
2. Top Surface: Leveled.

2.3 FRAMES AND COVERS

A. Description:

1. Materials of Construction:

a. Cast iron.
b. Comply with ASTM A48/A48M; Class 30B

2. Lid:

a. Size: As indicated on Drawings.
b. Surface: Machined flat bearing.
c. Type: Removable.
d. Security: Lockable.

3. Cover:

a. Design: Closed.
b. Fabrication: Molded.
c. Identification: Cast with municipality name.

4. Furnish sealing gasket.
5. Grate:

a. Configuration: Bicycle safe.
b. Size: As indicated on Drawings.

2.4 ACCESS HATCHES

A. Description:

1. Materials of Construction: Steel; welded.
2. Size: As indicated on Drawings.
3. Door Configuration: Single.
4. Cover:

a. Fabrication: Diamond plate.
b. Reinforce with structural stiffeners as required to support indicated loads.

5. Frame:

a. Type: Angle.
b. Furnish integral seat to support cover stiffeners as required.
c. Anchor flange around frame perimeter.

6. Hinge Material: Stainless steel.
7. Lift Handle:

a. Type: Flush drop; non-removable.
b. Mounting: In cover.

8. Lifting Mechanism:

a. Compression Springs: Stainless steel.
b. Furnish automatic hold-open and dead stop to retain cover in open position.
c. Cover springs to prevent contact by personnel entering vault or chamber.

9. Latch Mechanism:

a. Lock: Stainless steel.
b. Furnish removable external handle and permanent internal release mechanism.

10. Hardware: Stainless steel.
11. Finishes: Unfinished.

2.5 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

B. Material and Resource Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site.

3. Certified Wood Materials: Furnish wood materials certified according to FSC standards.

2.6 MATERIALS

A. Concrete:

1. Portland Cement:

a. Comply with ASTM C150.
b. Type: I - Normal.

2. Fine and Coarse Aggregates: Comply with ASTM C33, except that gradation requirements do not apply.
3. Water: Clean and not detrimental to concrete.

B. Admixtures:

1. Air Entrainment: Comply with ASTM C260.
2. Chemical Admixtures:

a. Comply with ASTM C494.
b. Type: E - Water Reducing and Accelerating.

3. Fly Ash: Comply with ASTM C618, Class C.
4. Blast Furnace Slag: Comply with ASTM C989, Grade 100.

C. Concrete Reinforcement:

1. Reinforcing Steel:

a. Comply with ASTM A706.
b. Yield Strength: 60 ksi (420 MPa).
c. Bars: Plain; low-alloy steel.
d. Finish: Epoxy coated.

2. Reinforcing Wire:

a. Plain Wire:

1) Comply with ASTM A1064.
2) Finish: Epoxy coated.

b. Deformed Wire:

1) Comply with ASTM A1064.
2) Finish: Epoxy coated.

3. Welded Steel Wire Fabric:

a. Plain Wire:

1) Comply with ASTM A1064.
2) Finish: Epoxy coated.

b. Deformed Wire:

1) Comply with ASTM A1064.
2) Finish: Epoxy coated.

2.7 FABRICATION

A. Comply with ACI 318 and NPCA Quality Control Manual for Precast and Prestressed Concrete Plants.

B. Fabricate vaults, chambers, and openings to size and configuration as indicated on Drawings.

C. Forms:

1. Fabricate to provide uniform precast concrete units with consistent dimensions.
2. Clean after each use.

D. Reinforcing:

1. Install reinforcement by tying or welding to make rigid assemblies.
2. Position reinforcement to maintain minimum 1/2-inch cover.
3. Secure reinforcement to prevent displacement while placing concrete.

E. Position and secure embedded items to prevent displacement while placing concrete.

F. Deposit concrete in forms and consolidate concrete without segregating aggregate.

G. Provide initial curing by retaining moisture using one of following methods:

1. Cover with PE sheets.
2. Cover with burlap or other absorptive material and keep continually moist.
3. Apply curing compound according to manufacturer instructions.

H. Provide final curing according to manufacturer's standard.

I. Remove forms without damaging concrete.

2.8 MIXES

A. Concrete:

1. Normal Weight: Select proportions according to ACI 2111.1 and 318.
2. Concrete Criteria:

a. Compressive Strength: 4,000 psi at 28 days.
b. Water-Cement Ratio:

1) Concrete Exposed to Freezing and Thawing: Maximum 0.45 percent by mass.
2) Watertight Concrete Not Exposed to Freezing and Thawing: Maximum 0.48 percent by mass.
3) Concrete Exposed to Corrosive Conditions: 0.40 percent by mass.

c. Air Content:

1) Maximum Aggregate Size of 3/8 Inch (9 mm):

a) Severe Exposure: 6.0 to 9.0 percent.
b) Moderate Exposure: 4.5 to 7.5 percent.

2) Maximum Aggregate Size of 1/2 Inch (13 mm):

a) Severe Exposure: 5.5 to 8.5 percent.
b) Moderate Exposure: 4.7 to 7.0 percent.

3) Maximum Aggregate Size of 3/4 Inch (18 mm):

a) Severe Exposure: 4.5 to 7.5 percent.
b) Moderate Exposure: 3.5 to 6.5 percent.

3. Admixtures:

a. Include admixture types and quantities indicated in concrete mix designs approved through submittal process.
b. Do not use calcium chloride.

2.9 FINISHES

A. Reinforcing Steel:
1. Epoxy-Coated Finish: Comply with ASTM A775.

B. Wire and Wire Fabric:

1. Epoxy-Coated Finish: Comply with ASTM A884.

C. Concrete:

1. Formed Surfaces Not Exposed to View: As formed.
2. Unformed Surfaces:

a. Finish with vibrating screed or hand float.
b. Items Permitted: Color variations, minor indentations, chips, and spalls.
c. Items Not Permitted: Major imperfections, honeycomb, or other such defects.

3. Exposed-to-View Finishes:

a. Surfaces: Light broom.

D. Steel:

1. Galvanizing:

a. Comply with ASTM A123.
b. Hot-dip galvanize after fabrication.

2.10 ACCESSORIES

A. Membrane Curing Compound: Comply with ASTM C1315, Type II, Class A.

B. Joint Sealants and Joint Gaskets:

1. Gasket Joints for Circular Concrete Pipe:

a. Comply with ASTM C443.
b. Gaskets: Oil-resistant rubber.

2. External Sealing Bands:

a. Comply with ASTM C877.
b. Material: Type I, rubber and mastic.

3. Preformed Joint Sealants for Concrete Pipe and Box Sections: Comply with ASTM C990 .
4. Elastomeric Joint Sealants:

a. Comply with ASTM C920.
b. Material: Polyurethane.
c. Grade NS, Class 25.

C. Pipe Entry Connectors: Comply with ASTM C923.

D. Grout:

1. Cement Type: Portland cement, sand, and water mixture with stiff consistency to suit intended purpose.
2. Nonshrink Type:

a. Description: Premixed compound consisting of nonmetallic aggregate, cement, and water-reducing and plasticizing agents.
b. Comply with ASTM C1107.
c. Minimum Compressive Strength: 2,400 psi in 48 hours, and 7,000 psi in 28 days.

E. Bituminous Coating:

2.11 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing:

1. Perform following tests for each 150 cu. yd. of concrete placed with minimum one set of tests each week:

a. Slump: Comply with ASTM C143.
b. Compressive Strength: ASTM C31 and ASTM C39/C39M.
c. Air Content: Comply with ASTM C231 or ASTM C173.

d. Unit Weight: Comply with ASTM C138.

2. Make test results available to Owner upon request.

C. Inspection:

1. Visually inspect completed vaults and chambers for defects.
2. Repair defects on surfaces exposed to view to achieve uniform appearance.
3. Repair honeycomb by removing loose material and applying grout to produce smooth surface flush with adjacent surface.
4. Repair major defects only if permitted by Owner.

D. Owner Inspection:

1. Make completed vault available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least seven days before inspection is allowed.

E. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven days before inspections and tests are scheduled.

F. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that items provided by other Sections of Work are properly sized and located.

C. Verify correct size and elevation of excavation.

D. Verify that subgrade and bedding are properly prepared, compacted, and ready to receive Work of this Section.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Mark each vault or chamber by indentation or using waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

C. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.

D. Do not install vault or chamber if Site conditions induce loads exceeding weight capacity of vault or chamber.

E. Inspect vaults and chambers immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.3 INSTALLATION

A. According to ASTM C891.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.

C. While lowering vaults or chambers into excavations and joining pipe to units, take precautions to ensure that interiors of pipeline and structure remain clean.

D. Install vaults and chambers to elevation and alignment as indicated on Drawings.

E. Excavating:

1. As specified in Section 312316 - Excavation and in indicated locations and depths.
2. Provide clearance around sidewalls of manhole or structure for construction operations, granular backfill, and placement of geotextile filter fabric.
3. If ground water is encountered, prevent accumulation of water in excavations; place manhole or structure in dry trench.
4. Remove large stones or other hard matter impeding consistent backfilling or compaction.
5. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation as approved by Architect/Engineer.
6. Correct over-excavation with fine aggregate.

F. Base and Alignment:

1. Install vaults and chambers supported at proper grade and alignment on compacted crushed-stone bedding.
2. Grout base of shaft to achieve slope to drain, trowel smooth, and contoured.

G. Assembly of Multisection Structures:

1. Lower each section into excavation.
2. Clean joint surfaces.
3. Install watertight joint seals according to manufacturer instructions using gasket joints, or grout.

H. Knock-out Boxes:

1. Remove knock outs or cut structure to receive piping without creating openings larger than required to fit pipe.
2. Fill annular space with grout.

I. Connections:

1. Connect pipe to structure and seal watertight.
2. Cut pipe flush with interior of structure.

J. Paint interior with two coats of bituminous interior coating at rate of 120 sq. ft./gal. for each coat.

K. Frame and Cover and Access Hatch:

1. Set level, without tipping, to elevations as indicated on Drawings.
2. Set cover and access hatch 2 inches above finished grade for structures located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
3. Connect drain from access hatch frame to storm drainage system.
4. Touch up damaged galvanized coatings.

L. Backfill excavations for vaults and chambers as specified in Section 312316 - Excavation and 312323 - Fill.

3.4 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing:

1. As specified in Section 330505.33 - Infiltration and Exfiltration Testing.

3.5 ATTACHMENTS

A. Grease Interceptor, Type 1:

1. Capacity: 800 gal..

a. Clear Inside Dimensions: 5 feet 10 inches by 7 feet 10 inches.
b. Height: As indicated on Drawings.

2. Roof: Access openings to grease collection and water discharge chambers.
3. Frame and Lid:

a. Type: Round, non-rocking.
b. Size: 24 inches.
c. Mounting: Flush.
d. Manufacturer: Neenah Foundry.

4.

END OF SECTION 33 05 63

SECTION 33 05 97 - IDENTIFICATION AND SIGNAGE FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipeline marker posts.
2. Metal utility markers.
3. Plastic utility markers.
4. Marking flags.
5. Plastic ribbon tape for placement above direct-buried utility.
6. Trace wire for placement above direct-buried utility.

B. Related Requirements:

1. Section 312316.13 - Trenching: Backfilling considerations for installation of underground pipe markers.
2. Section 312323 - Fill: Backfilling considerations for installation of underground pipe markers.
3. Section 331416 - Site Water Utility Distribution Piping: Piping, valves, and appurtenances requiring identification marking.
4. Section 333100 - Sanitary Sewerage Piping: Piping, valves, and appurtenances requiring identification marking.
5. Section 333111 - Public Sanitary Sewerage Gravity Piping: Piping, valves, and appurtenances requiring identification marking.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit one pipeline marker post, utility marker, marking flag, 10 feet of ribbon tape, and10 feet of trace wire.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.3 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged valves.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials:

1. Furnish two pipeline marker posts, two utility markers, five marking flags, one roll of ribbon tape, and one roll of trace wire].

1.5 QUALITY ASSURANCE

A. Perform Work according to local municipality standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 PIPELINE MARKER POSTS

A. Description:

1. Material: HDPE.
2. Diameter: 3-1/2 inches.
3. Length: 72 inches.
4. Color: White.
5. Embedment: T-anchor.

B. Visibility Enhancer:

1. Material: PE.
2. Length: 24 inches.
3. Diameter: 3-3/4 inches.

2.2 UTILITY MARKERS

A. Metal:

1. Material: Bronze.
2. Diameter: 2 inches.
3. Stem: 3/4 by 2 inches.

2.3 MARKING FLAGS

A. Description:

1. Material: PE.
2. Minimum Size: 2-1/2 by 3-1/2 inches.
3. Wire Stem: 21 inches.

2.4 RIBBON TAPE

A. Description:

1. Material: PE.
2. Brightly colored, continuously printed.
3. Minimum Size: 6 inches wide by 4 mils thick.
4. Manufactured for direct burial service.

2.5 TRACE WIRE

A. Description:
1. Wire: Unshielded 10-AWG 10-gage Type THWN insulated copper.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipeline Marker Posts, Utility Markers, and Marking Flags: According to manufacturer instructions.

B. Installation Standards: Install Work according to local municipality standards.

END OF SECTION 33 05 97

SECTION 33 14 17 - SITE WATER SERVICE UTILITY LATERALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for water service connections to buildings.
2. Corporation stop assemblies.
3. Curb stop assemblies.
4. Backflow preventers.
5. Meter setting equipment.
6. Meter boxes.
7. Trenching, bedding, and cover.

B. Related Requirements:
1. Section 310513 - Soils for Earthwork: Backfill-soil type.
2. Section 312316.13 - Trenching: Excavation of pipe trench.
3. Section 312323 - Fill: Backfilling of trench.
4. Section 330110.58 - Disinfection of Water Utility Piping Systems: Flushing and disinfecting of water system.
5. Section 330509.33 - Thrust Restraint for Utility Piping: Thrust restraints as required by this Section.
6. Section 330563 - Concrete Vaults and Chambers

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Pipe and Fittings:

1. Basis of Measurement: By linear foot.
2. Basis of Payment: Includes hand-trimming excavation, pipe and fittings, bedding, thrust restraints, connection to building service piping, and municipal utility water source.

C. Corporation Stop Assemblies:

1. Basis of Measurement: By unit.
2. Basis of Payment: Includes corporation stop, fittings, and accessories.

D. Curb Stop Assemblies:

1. Basis of Measurement: By unit.
2. Basis of Payment: Includes curb stop, curb box and cover, fittings, and accessories.

E. Backflow Preventers:

1. Basis of Measurement: By unit.
2. Basis of Payment: Includes backflow preventer, fittings, box, vault, and accessories.

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

B. American Society of Sanitary Engineering:

1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

C. ASTM International:

1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
3. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
5. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
7. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
8. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
9. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

D. American Welding Society:

1. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding.

E. American Water Works Association:

1. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
2. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
3. AWWA C800 - Underground Service Line Valves and Fittings.
4. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventers, and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, pressure-pipe centerline elevations, and gravity-pipe invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work according to Colorado Department of Transportation standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Copper Tubing:

1. Comply with ASTM B88.
2. Type: K annealed.
3. Fittings: Cast copper; ASME B16.18.
4. Joints: Compression connection.

B. Corporation Stops:

1. Comply with ASTM B62.
2. Body: Brass or red brass alloy.
3. Inlet End: Threaded for tapping according to AWWA C800.
4. Outlet End: Suitable for service pipe specified.

C. Service Saddles:

1. Type: Double strap.
2. Designed to hold pressures in excess of pipe working pressure.

2.2 CURB STOP ASSEMBLIES

A. Curb Stops:

1. Body: Brass or red brass alloy.
2. Comply with ASTM B62.
3. Valve Type: Plug.
4. Sealing: Positive pressure.

2.3 BACKFLOW PREVENTERS

A. Reduced-Pressure Backflow Preventers:

1. Comply with ASSE 1013.
2. Provide below or equal:

a. Manufacturer: Zurn Walter, LLC
b. Model: 975 XL2
c. Model Size: 2-inch

3. Check Valves:

a. Quantity: Two, operating independently operating.
b. Spring-loaded.
c. Third Check Valve: Open under back pressure in case of diaphragm failure.

4. Differential Pressure Relief Valve:

    a. Type: Diaphragm.
    b. Location: Between check valves.

5. Gate Valves:

    a. Type: Resilient seated.
    b. Comply with AWWA C509.

6. Accessories:

    a. Non-threaded vent outlet.
    b. Strainer.
    c. Four resilient-seated ball valve test cocks.

B. Double-Check Valve Assemblies:

1. Comply with ASSE 1012.
2. Materials:

    a. Body: Bronze.
    b. Internal Parts: Corrosion resistant.
    c. Springs: Stainless steel.

3. Check Valves:

    a. Quantity: Two, operating independently.
    b. Intermediate atmospheric vent.

2.4 WATER METERS

A. Provide Below or Equal:

1. Manufacturer: Badger Meter
2. Model: E-Series G2
3. Meter Size: 2-inch

    a. Outlet: Expansion connection.
    b. End Connections: Flared copper tubing.

2.5 MATERIALS

A. Bedding and Cover:

B. Bedding: Fill as specified in Section 310516 - Aggregates for Earthwork.

C. Cover: Fill Type as specified in Section 310516 - Aggregates for Earthwork.

D. Soil Backfill from Above Pipe to Finish Grade:

1. Soil Type as specified in Section 310513 - Soils for Earthwork.
2. Subsoil: No rocks greater than 6 inches in diameter, frozen earth, or foreign matter.

2.6 ACCESSORIES

A. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

B. Precast Concrete Vaults: As specified in Section 330563 - Concrete Vaults and Chambers.

C. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that building service connections and municipal utility water main sizes, locations, and inverts are as indicated on Drawings.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

C. Remove scale and dirt from inside and outside of piping before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Corporation Stop Assemblies:

1. Make connection for each different kind of water main, using suitable materials, equipment, and methods as approved by Contracting Officer.
2. Provide service clamps for mains constructed of materials other than cast iron or ductile iron.
3. Location:

    a. Screw corporation stops directly into tapped and threaded iron main at 10- and 2-o'clock positions along main's circumference.
    b. Locate and stagger corporation stops at least 12 inches apart longitudinally.

4. Plastic Pipe Mains:

a. Provide full support for service clamp for full circumference of pipe, with minimum 2-inch width of bearing area.
b. Exercise care against crushing or causing other damage to mains at time of tapping or installation of service clamp or corporation stop.

5. Use seals or other devices such that no leaks are present in mains at points of tapping.
6. Do not backfill and cover service connections until installation has been approved by Contracting Officer.

B. Bedding:

1. Excavate pipe trench as specified in Section 312316.13 - Trenching.
2. Placement:

a. Place bedding material.
b. Level fill materials in one continuous layer not exceeding 6 inches of compacted depth.
c. Compact to 95 percent maximum density.

3. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to 95 percent maximum density.

C. Pipe and Fittings:

1. Maintain separation of water main from sewer piping according to code.
2. Group piping with other Site piping Work whenever practical.
3. Install pipe to allow for expansion and contraction without stressing pipe or joints.
4. Install access fittings to permit disinfection of water system.
5. Thrust Restraints: Form and place concrete for thrust restraints at each elbow or change of direction of pipe.
6. Establish elevations of buried piping with not less than 1 feet of cover.
7. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
8. Backfill trench as specified in Section 312323 - Fill.

D. Curb Stop Assemblies:

1. Set curb stops on solid bearing.
2. Boxes:

a. Center and plumb curb boxes over curb stops.
b. Set box cover flush with finished grade.

E. Water Meters: Install positive displacement meters according to AWWA M6, with isolating valves on inlet and outlet as indicated on Drawings.

F. Backflow Preventers:

1. Install backflow preventers where indicated on Drawings and according to manufacturer instructions.
2. Testing and Installation Requirements: Comply with local water company requirements and plumbing codes.

G. Service Connections:

1. Install water service as indicated on Drawings.
2. Install water service to within 5 feet of building and connect to building water service as specified in Section 221100 - Facility Water Distribution.

H. Precast-Concrete Vaults: As specified in Section 330563 - Concrete Vaults and Chambers.

I. Installation Standards: Install Work according to Colorado Department of Transportation standards.

3.4 TOLERANCES

A. Install pipe to indicated elevation to within tolerance of 5/8 inch.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Testing:

1. Pressure test system according to AWWA C600 and following:

a. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
b. Conduct hydrostatic test for a minimum of two hours.
c. Slowly fill with water section to be tested, and expel air from piping at high points.
d. Install corporation cocks at high points.
e. Close air vents and corporation cocks after air is expelled.
f. Raise pressure to specified test pressure.
g. Observe joints, fittings, and valves under test.
h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage. Retest.
i. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psi of test pressure.
j. Leakage is defined as quantity of water supplied to piping as necessary to maintain test pressure during testing period.
k. Compute maximum allowable leakage using following formula:

1) $L = SD \times \sqrt{P}/C$.
2) L = testing allowance, gph.
3) S = length of pipe tested, feet.
4) D = nominal diameter of pipe, inches.
5) P = average test pressure during hydrostatic test, psig.
6) C = 148,000.

l. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
m. Leakage:

1) If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
2) Correct visible leaks regardless of quantity of leakage.

C. Compaction Testing for Bedding: Comply with ASTM D1557.

D. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 33 14 17

SECTION 33 14 19 - VALVES AND HYDRANTS FOR WATER UTILITY SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Valves.
2. Valve boxes.
3. Fire hydrants.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints.
2. Section 330110.58 - Disinfection of Water Utility Piping Systems: Requirements for flushing and disinfecting.
3. Section 330509.33 - Thrust Restraint for Utility Piping: Thrust restraints as required by this Section.
4. Section 331416 - Site Water Utility Distribution Piping: Pressure testing of valves and hydrants.
5. Section 331417 - Site Water Service Utility Laterals: Piping, trenching, backfilling, and compaction requirements.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
2. AWWA C502 - Dry-Barrel Fire Hydrants.
3. AWWA C503 - Wet-Barrel Fire Hydrants.
4. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
5. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

B. National Fire Protection Association:

1. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants.

C. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with installation of water mains.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information regarding component materials, fittings, assembly and parts diagram, and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves and hydrants.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Tools: Furnish one tee wrench of required length to Government.

1.7 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

B. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.

C. Perform Work according to Colorado Department of Transportation standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Delivery:

1. Seal valve and hydrant ends to prevent entry of foreign matter.
2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 VALVES

A. Performance and Design Criteria:

1. Pressure Rating:

a. 12-inch Diameter and Smaller: 200 psig.
b. 14-inch Diameter and Larger: 150 psig.

2. End Connections: Flanged.
3. Furnish valves of diameters 16 inches and larger with bypass valves and gear operators.
4. Coatings:

a. Comply with AWWA C550.
b. Application: Interior and exterior.

B. Double-Disc Gate Valves:

1. Manufacturers:
a. Furnish materials according to Colorado Department of Transportation standards.

2. Description:

a. Comply with AWWA C500.
b. Materials:

1) Body: Iron.
2) Trim: Bronze.

c. Seat Type: Double disc; parallel.
d. Stem:

1) Type: Non-rising.
2) Seals: O-ring.

e. Operation:

1) Square operating nut.
2) Opening Direction: Counterclockwise.

C. Resilient-Wedge Gate Valves:

1. Manufacturers:
a. Furnish materials according to Colorado Department of Transportation standards.

2. Description:

a. Comply with AWWA C509.
b. Body: Ductile iron.
c. Seats: Resilient.
d. Stem:

1) Type: Non-rising.
2) Material: Bronze.

e. Operation:

1) Square operating nut.
2) Opening Direction: Counterclockwise.

2.2 FIRE HYDRANTS

A. Manufacturers:
1. Furnish materials according to Colorado Department of Transportation standards.

B. Dry-Barrel, Breakaway Type:

1. Comply with AWWA C502.
2. Body: Cast iron.
3. Valve: Compression type.
4. Burial Depth: As indicated on Drawings.
5. Inlet Connection Size: 6 inches.

6. Valve Opening: 5-1/4 inches in diameter.
7. End Connections: Mechanical joint.
8. Bolts and Nuts: Galvanized steel.
9. Interior Coating: Comply with AWWA C550.
10. Opening Direction: Counterclockwise.

C. Wet-Barrel Type:

1. Comply with AWWA C503.
2. Body: Cast iron.
3. Valve Openings: Individual for pumper and hose nozzles.
4. End Connections: Mechanical joint.
5. Bolts and Nuts: Galvanized steel.
6. Interior Coating: Comply with AWWA C550.
7. Opening Direction: Counterclockwise.

D. Hose Connections:

1. One pumper, two hose nozzles.
2. Obtain thread type and size from local fire department.
3. Attach nozzle caps by separate chains.

E. Finishes:

1. Primer and two coats of enamel.
2. Color: Comply with requirements of applicable fire department.

2.3 VALVE BOXES

A. Manufacturers:
1. Furnish materials according to Colorado Department of Transportation standards.

B. Description:

1. 12-inch Diameter Valves and Smaller:

a. Material: Cast iron.
b. Type: Two piece; screw.

2. Valves Larger than 12-inch Diameter:

a. Material: Cast iron.
b. Type: Three piece; screw.
c. Base: Round.

3. Lid Inscription: WATER.

2.4 ACCESSORIES

A. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping.

B. Valve Box Aligner: High-strength plastic device designed to automatically center valve box base and to prevent it from shifting off center during backfilling.

C. Fire Hydrant Drainage Gravel: As specified in Section 310516 - Aggregates for Earthwork.

2.5 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Government Inspection:

1. Make completed valves and hydrants available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Government at least seven days before inspection is allowed.

C. Government Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Government at least seven days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Determine exact location and size of valves from Drawings.

C. Identify required lines, levels, contours, and datum locations.

D. Verify that elevations of existing facilities prior to excavation and installation of valves and hydrants are as indicated on Drawings.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Locate, identify, and protect from damage utilities to remain.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1. Notify Contracting Officer not less than 7 days in advance of proposed utility interruption.
2. Do not proceed without written permission from Contracting Officer.

3.3 INSTALLATION

A. Perform trench excavation, backfilling, and compaction as specified in Section 331417 - Site Water Service Utility Laterals.

B. Install valves and hydrants in conjunction with pipe laying.

C. Provide buried valves with valve boxes installed flush with finished grade.

D. Provide support blocking and drainage gravel while installing fire hydrants; do not block drain hole.

E. Orientation:

1. Set valves and hydrants plumb.
2. Set fire hydrants with pumper nozzle facing roadway.
3. Set fire hydrants with centerline of pumper nozzle 18 inches above finished grade and with safety flange not more than 6 inches nor less than 2 inches above grade.

F. After main-line pressure testing, flush fire hydrants and check for proper drainage.

G. Installation Standards: Install Work according to Colorado Department of Transportation standards.

H. Disinfection of Water Piping System: Flush and disinfect valves and hydrants with water mains as specified in Section 330110.58 - Disinfection of Water Utility Piping Systems.

3.4 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing: Pressure test valves and hydrants with water mains as specified in 331416 - Site Water Utility Distribution Piping.

END OF SECTION 33 14 19

SECTION 33 31 00 - SANITARY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewerage piping.
2. Bedding and cover materials.

B. Related Requirements:
1. Section 310513 - Soils for Earthwork: Soil for backfill in trenches.
2. Section 312316 - Excavation: Requirements for excavation and backfill as required by this Section.
3. Section 312316.13 - Trenching: Requirements for trenching as required by this Section.
4. Section 312323 - Fill: Requirements for backfilling as required by this Section.
5. Section 330505.33 - Infiltration and Exfiltration Testing: Infiltration testing of gravity-flow sewerage piping.
6. Section 330597 - Identification and Signage for Utilities: Pipe markers.

1.2 DEFINITIONS

A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.3 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
7. AWWA C153 - Ductile-Iron Compact Fittings.

B. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
7. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
8. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
9. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
11. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
13. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
14. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
15. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
16. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
17. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to sewer main, and trenching.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information indicating pipe material to be used and pipe accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Source Quality-Control Submittals: Indicate results of **factory** tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:

1. Submit qualifications for manufacturer and installer.

G. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

H. Project Record Documents: Record finished locations of pipe runs, connections, manholes, cleanouts, and invert elevations.

I. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work according to Colorado Department of Transportation standards.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:

1. Store materials according to manufacturer instructions.
2. Store valves in shipping containers with labeling in place.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPING

A. Ductile-Iron Pipe:

1. Comply with AWWA C150.
2. Minimum Pressure Class: 150.

3. Lining:

a. Cement mortar lined.
b. Comply with AWWA C104.

4. Lining:

a. Seal coating applied to lining at following thickness:

1) Nominal Pipe Sizes 6 through 12 Inches: 1/8 inch.

5. Lining:

a. Type: Asphaltic sealcoat.
b. Minimum Uniform Thickness: 1 mil.
c. Comply with AWWA C104.

6. PE Encasement: Comply with AWWA C105.
7. Fittings:

a. Material: Ductile iron, Class 52 or greater.
b. Comply with AWWA C153.
c. Lining: Cement-mortar lined according to AWWA C104.

8. Coating:

a. Coat pipe and fittings exposed inside of structures with two coats of bituminous paint.
b. As specified in Section 099000 - Painting and Coating.

9. Joints:

a. Rubber gasket joint devices.
b. Comply with AWWA C111.

B. Plastic Pipe:

1. Material: PVC.
2. Comply with ASTM D2729.
3. Inside Nominal Diameter: according to the design drawings.
4. End Connections: Bell and spigot with solvent-sealed ends.
5. Fittings: PVC.

6. Joints:

a. Solvent welded with solvent cement conforming to ASTM D2564.
b. Comply with ASTM D2855.

2.2 MANHOLES

A. As specified in Section 330561 - Concrete Manholes.

2.3 FLEXIBLE COUPLINGS

A. Manufacturers:
1. Furnish materials according to Colorado Department of Transportation standards.

B. Description:

1. Material: Resilient, chemical-resistant, elastomeric PVC.
2. Attachment: Two stainless-steel clamps, screws, and housings.

2.4 FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES

A. Manufacturers:
1. Furnish materials according to Colorado Department of Transportation standards.

B. Description:

1. Material: EPDM.
2. Comply with ASTM C923.
3. Attachment: stainless-steel clamp and hardware.

C. Bedding and Cover:

1. Bedding: Fill Type as specified in Section 310516 - Aggregates for Earthwork.
2. Cover: Fill Type as specified in Section 310516 - Aggregates for Earthwork.
3. Soil Backfill from Above Pipe to Finish Grade:

a. Soil Type as specified in Section 310513 - Soils for Earthwork.
b. Subsoil with no rocks more than 6 inches in diameter, frozen earth, or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that trench cut and excavation base is ready to receive Work of this Section.

C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Correct over-excavation.

C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

D. Protect and support existing sewer lines, utilities, and appurtenances.

E. Utilities:

1. Maintain profiles of utilities.
2. Coordinate with other onsite utilities to eliminate interference.
3. Notify Contracting Officer if crossing conflicts occur.

3.3 INSTALLATION

A. Bedding:

1. Excavate pipe trench as specified in Section 312316.13 - Trenching.
2. Place bedding material at trench bottom.
3. Level materials in continuous layer not exceeding 6 inches.
4. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Piping:

1. Install pipe, fittings, and accessories according to ASTM D2321, and seal joints watertight.
2. Lay pipe to slope gradients as indicated on Drawings.
3. Begin at downstream end of system and progress upstream.
4. Bedding: Install at sides and over top of pipe, to minimum compacted thickness of 12 inches.
5. Backfill and compact as specified in Section 312316.13 - Trenching.
6. Do not displace or damage pipe when compacting.
7. Connect to building sanitary sewer outlet and municipal sewer system.
8. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
9. Install Site sanitary sewage system piping to within 5 feet of building and connect to building sanitary waste system as specified in Section 221300 - Facility Sanitary Sewerage.

C. Manholes: As specified in Section 330561 - Concrete Manholes.

D. Backfilling:

1. Backfill around sides and to top of pipe with cover fill in minimum lifts of 6 inches.
2. Tamp fill in place, and compact to **95** percent of maximum density.

3. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.
4. Maintain optimum moisture content of bedding material as required to attain specified compaction density.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

A. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Perform testing on Site sanitary sewage system according to local code and local Public Work's standards.

3. Compaction Testing:

a. Comply with AASHTO T 180.

3.6 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

C. Cap open ends of piping during periods of Work stoppage.

END OF SECTION 33 31 00